## 3 Normative engines

Throughout the nineteenth century models of invention gathered in the United States Patent Office, where they represented machines and devices of all kinds: clothespins and locks, sewing machines and steam generators, locomotives and telegraph systems. Patent applications, notably those relating to machine patents, were accompanied by scaled-down models which were fashioned (often by specialist model-makers) in such a way as to display the inventive features of an artifact. Early in the century this collection of models – which was popularly known as Dr Thornton's Toy Shop[1] – became an unlikely tourist attraction and a valuable resource for 'mechanicians' and aspiring inventors.[2] When the Patent Office moved into a specially-constructed building in 1840, three wings of the quadrangle, which was completed only in 1867, were laid out as exhibition halls with vast glass cases in which selected models were displayed to the public, forming 'a veritable museum of American technology'.[3] This is how patent models are still seen: as 'icons of innovation' (to borrow the title of an exhibition curated by the Patent and Trademark Office Museum in 2002) or as antiques that express the energy and diversity of nineteenth-century American inventors. The patent models that one now sees displayed in illustrated histories, exhibition catalogues and online auction pages are interesting for diverse reasons – the notoriety of the inventor, the significance or perversity of the invention, the specific architecture of the model – but in each case interest is first engaged by the peculiarity of the medium. Perhaps mechanisms are inherently fascinating; in his introduction to a selection of essays on 'philosophers and machines', Otto Mayr observes that 'constructing, operating, even watching machines provides satisfactions and delights that can be intense enough to become ends in themselves'.[4] Perhaps too there is a sense in which mechanisms are now inherently antique. In 1991, a working example of Charles Babbage's 'Difference Engine No2' was built by the Science Museum in London, using plans that Babbage had drawn up more than a century and a half earlier but had been unable to realize in his own lifetime. This machine was made to be old; cast as an ancestor from the age before transistors and microprocessors it 're-enchanted the modern

[1] So called after William Thornton, the first Superintendent of the Patent Office.

[2] See The Hagley Museum, *Little Machines: Patent Models in the Nineteenth Century* (The Hagley Museum: Delaware, 1979), at p 6, citing the remarks made by one contemporary that he 'saw movements and combinations there, of which, before, he had no idea, and was in consequence now so enabled to improve machinery, as to reduce the price of spinning wool'.

[3] *Little Machines*, at p 11.

[4] Mayr, at p 4.

computer'[5] by giving it an almost magical origin in the cogs and escapements of Victorian machinery. Patent models have a similarly anachronistic charm.

Framed in these terms patent models are exhibits from the history of technology: the medium itself represents an era in which ingenuity was embodied in artisans rather than corporate organization, in which manufacturing processes were based on craft skills rather than production technologies, and in which mechanical models were expressions of 'folk art'.[6] But there is something missing in this historiographical presentation of models, a sense of the vital role that patent models played in the evolution of patent law. Although there are historical accounts of the life of models within the Patent Office very little has been written about the essential role that these models played in litigation throughout the nineteenth century. Patent models only came to life as legal instruments when they were transported – or copied over – from the Patent Office to the courtroom. In 1877 a former Commissioner of Patents stated that 'while I originally thought that models were mere traps, curiosities, interesting to the public to look at, the more I have given my attention to the matter, the more firmly I am of the opinion that they are absolutely necessary for the protection both of the community and of patentees. The Patent Office could get along better without them than the courts'.[7] Whereas patent examiners could easily reconstruct a machine from a set of drawings, judges and jurors could not be relied upon to do the same: they were unable to 'make the lines of a drawing stand out and portray the invention'. The result was that most patent infringement actions turned on arguments made through the material rhetoric of a model. In court, models were not just items of evidence; they were means for exhibiting, fabricating and reproducing legal doctrine. Figuratively, patent law itself was machine made.

**The form of the model**

The first United States patent act, which was made in 1790, required inventors to submit models with their patent applications 'if the nature of the invention or discovery will admit of a model.[8] This requirement was left out of the patent act of 1793, which stipulated that the applicant was to submit a model only where the Secretary of State deemed it to be 'necessary' to do so.[9] So the routine use of

[5] Francis Spufford, 'The Difference Engine and *The Difference Engine*', in Francis Spufford & Jenny Uglow (eds), *Cultural Babbage. Technology, Time, and Invention* (London, Faber & Faber, 1996), 266-290,, at 270.

[6] See Ray and ray, at p xx.

[7] General Mortimer Leggett, giving evidenmce to the xxx f/n below.

[8] Patent Act of 1790, Ch. 7, 1 Stat. 109-112 (April 10, 1790), section 2. On the legislative history of this provision see Kendall J. Dood 'Patent Models and the Patent Law: 1790-1880 (Part I)' (1983) 65 *Journal of the Patent Office Society* 187-216, esp pp 193-200.

[9] Patent Act of 1793, Ch. 11, 1 Stat. 318-323 (February 21, 1793), section 3.

models by inventors, lawyers and administrators in the decades before 1836, when a new patent act restored the model requirement, cannot be explained by reference to the prevailing legislation. Models became an established means of communicating invention because they were adapted to a form of mechanical knowledge in which machines were apprehended as 'sensible objects',[10] or as visible and manipulable artifacts.[11] Machines (or their more portable surrogates) traveled between inventors, inventors traveled between workshops, and demonstrations of mechanical models were the means of instruction of a new generation of 'intelligent' or 'scientific' mechanic.[12] Although primers in mechanical principles and repertories of mechanical inventions were diffused from the eighteenth century onwards, and although some machines undoubtedly could be reproduced from texts and diagrams, models were uniquely persuasive. Thomas Jefferson, one of the authors of the first patent statute, once commissioned a model of one of his own inventions and sent it to his machine maker, precisely because it would have been 'difficult to make it from a description'.[13] Similarly, inventors often found it easier to communicate the principles of their invention to a patent attorney in the form of a model rather than a text or drawing.[14] The attorney would assess the novelty of the invention by comparing the inventor's model with those displayed in the Patent Office and would describe the innovative aspects of the invention in a text that was returned to the inventor for signature.[15] So, even in the absence of any formal requirement to do so, inventors routinely deposited models of their inventions with their patent applications and officials in the Patent Office expected that they should do so.[16] Kendall J Dood observes that by 1828 'models had become so important to the proper functioning of the patent system that the Office began requiring them not

[10] For the notion of sensible objects, see Simon Schaffer, 'Machine philosophy: demonstration devices in Georgian mechanics' (1994) 9 *Osiris* 157-182, esp. at p 167.

[11] See Joel Mokyr, *The Gifts of Athena. Historical Origins of the Knowledge Economy* (Princeton: Princeton University Press, 2002), pp 72-74.

[12] 'Of all the qualities that would distinguish the intelligent mechanic from the workman of the past, the most important was his knowledge of science. More particularly, it was his understanding of the scientific principles which lay behind his art. A thorough knowledge of those basic and unchanging natural laws, when united with skillful practice, would enable him to perceive new combinations of materials and new uses for them' (Bruce Sinclair, *Philadelphia's Philosopher Mechanics. A History of the Franklin Institute 1824-1865* (Baltimore MD: Johns Hopkins UP, 1974), at p 15). Need a ref on the mode of demonstration – the

[13] Dood's argument is that Jefferson may have promoted the amendment that ultimately led to the requirement in the 1790 Act that all patent applications should be accompanied by a model because ideas communicated in the form of models were more broadly comprehensible than ideas set in text, and that a patent system based on both models and texts would prevent 'the concentration of the benefits of new inventions in the hands of a few even after the patent expired (Kendall J. Dood, 'Patent Models and the Patent Law 1790-1880 (Part I) (1983) 65 *Journal of the Patent Office Society* 187-216, at p 197. Cf Edward C. Walterscheid, 'Thomas Jefferson and the Patent Act of 1793 (1998) 40 *Essays in History*, available at: http://etext.virginia.edu/journals/EH/EH40?walter40.html

[14] 1878 report on unskilled inventors

[15] See Kendall J. Dood, Pursuing the Essence of Inventions: Reissuing Patents in the 19th Century (1991) 32:4 *Technology and Culture* 999-1017, at 1005-1006.

[16] Dood (pat I p 202, estimates that between 1793 and 1823 about half of patent applications were accomoaned by a model, and observes that 'the high submission rate suggests that some new function of the models had been found, namely that uniquely proximate to the actual invention; 'the official patent model not only helped explain the invention, it also helped establish what exactly was protected by the patent' (at 205). In 1816, the Patent Office had established a workshop expressly for the painting of patent models (see The Patent Ofice Pony. A history of the early patent office, at p 68).

just in cases of complex machines but wherever the Office considered that 'the nature of the machine will be more clearly shown by a model than by drawings alone'.[17] When the statutory obligation to submit a model was reinstated in 1836 it merely ratified what had become the standard practice of the Patent Office and its clients.[18]

Even after 1836 there were few statutory or administrative prescriptions as to the scale or mode of construction of models submitted to the Office. Some patent models were crude homemade artifacts, but many of them were produced by the specialist model-making firms that established themselves in the vicinity of the Patent Office.[19] Advice given to inventors by the Patent Office in the 1849 stated only that 'the model should be neatly made, and as small as a distinct representation of the machine or improvement or its characteristic properties will admit; the name of the inventor should be printed or engraved upon or affixed to it in a durable manner',[20] and only in 1876, when models were no longer a central mean of representation, did the rules of the Patent Office impose clearer requirements, stipulating that a model should 'clearly exhibit every feature of the machine which forms the subject of a claim of invention, but should not include other matter than that covered by the actual invention or improvement, unless it is necessary to the exhibition of the model'.[21] Patent models did not evolve into the standardized artifacts that were sometimes used in the demonstration of mechanical science in the same period,[22] or in chemistry a century later;[23] nor, more importantly, could format, scale, and composition be standardized as thoroughly as they ultimately were in rules governing patent drawing. As a mode of representation, the patent model was as singular as the invention that it represented. Although all working models were scaled-down versions of the machine itself, they took various forms.[24] Models that represented improvements to

[17] ' , 'Why Models?', in Robert C. Post, *American Enterprise: Nineteenth-Century Patent Models* (New York: Cooper-Hewitt Museum, 1984) 14-16, at p 15. Dood goes on to note that (ibid, at p 15, citing a Patent Office document).

[18] Dood estimates that between 1790 and 1823 about 50% of all patent applications were accompanied by a model, and from 1823 and 1836, the proportion rose to 80% (Dood, part I, at pp 202 and 206).

[19] See generally Rice Odell, 'Patent models recall creativity of early America' (1973) 4:1 *Smithsonian* 59-63., and for a fuller discussion William Ray & Marlys Ray, *The Art of Invention: Patent Models and Their Makers* (Princeton: The Pyne Press, 1974)., where it is observed (at p 14) that the model makers were already established in 1812, and that the construction of the model was typically one of the most expensive aspects of the process of seeking a patent.

[20] George T Curtis, 'Information to persons having business to transact at the Patent Office' (1847) *American Conveyancer* 115-135, at 119.

[21] Kendall J .Dood, 'Patent Models and the Patent Law: 1790-1880 (Part II)' (1983) 65 *Journal of the Patent Office Society* 234-274, at 238. The requirement in the 1836 act was only that the model should be 'of a convenient size to exhibit advantageously its several parts' (section 6).

[22] See Simon Schaffer, 'Machine philosophy: demonstration devices in Georgian mechanics' (1994) 9 *Osiris* 157-182, for the example of Atwood's machine, designed in 1770, and widely on boith sids o fhe Atlantic by the turn of the entury.

[23] See generally Eric Francoeur, 'The forgotten tool: the design and use of molecular models' (1997) 27 *Social Studies of Science* 7-40.

[24] 'There [were] three basic categories of patent model: full-size prototypes such as dental impression cups, pipe-wrenches, or sewing machines; abstractions, models that disclosed a fundamental function but did so without reference to other parts of a machine, the classic example being a steam pump by George Westinghouse that simply showed a reciprocal motion and left everything else to the imagination; and miniatures, machines so complete and operational that they could well be used to turn out thousands of tiny products' (Benjamin Lawless, 'Working with working models' (1985) *American Heritage*,

existing devices – notably sewing machines – often played on scale or proportion to emphasize the novel element or improvement claimed by the inventor. So in many models, 'parts are obviously "missing" or made to different scales or exhibit different degrees of detail in their finish', precisely because the maker was trying 'to emphasize or render most clearly the new or improved features of the device'.[25] Nevertheless, models of machines had one common feature: they were working models,[26] which were used to demonstrate a periodic movement that could not easily be reduced to writing or drawing.

In 1811, William Thornton, Superintendent of the Patent Office from its foundation in 1802 until his death in 1828, observed that a model was typically often more persuasive than a textual description: 'If the machine be complex, a model will be necessary, not only to explain and render comprehensible to a common capacity, but also to prevent infringements of rights; for many will plead ignorance of drawings, who cannot avoid conviction by wheels and pinions'.[27] Although Thornton notoriously refused to publish the written specifications of registered patents, he readily opened the Model Room – his 'toy shop' – the public. Thornton's policy was formalized as a statutory requirement by the 1836 patent act,[28] and the collection remained open to the public until it was sold off in 1908.[29] Not all models were made public; models accompanying patent applications that had yet to be examined were kept in dedicated rooms that were out of bounds to the public – or opportunistic competitors.[30] Outside the patent office – notably in an infringement action – the model effectively became a portable icon of the machine; the 'principle' of the machine could be displayed in any venue to which the model was taken and in which the 'original' invention had to be

available at: www.americanheritage.com/articles/magazine/it/1985/2/1985_2_10.shtml, quote modified slightly).

[25] Dood, part 1, ap p

[26] 'A working model was generally preferred. In some cases, the "model" consisted of the invention itself, if it was small enough. A model did not have to demonstrate the whole machine, only that feature involved in the claim. But most models included all working parts, or at least a full mock-up of the machine' (Odell, at p 59). On the reasons why working models could not be required by the Patent Office, see Dood, part II, 243-246. An account of the process (started in 1925) of disposing of historically less significant models notes (with respect to sewing machine models) that 'each of these models can at the present time be made to work' (see J.A. Brearly, 'Old Patent Office Models' (1925-1926) 8 JPOS 280-284, at p 284).

[27] Kendall J. Dood, part I, at p 204.

[28] See Patent Act 1836 Act, Section 20: 'it shall be the duty of the Commissioner to cause to be classified and arranged, in such rooms or galleries as may be provided for that purpose, in suitable cases, when necessary for their preservation, and in such manner as shall be conducive to a beneficial and favorable display thereof, the models and specimens of compositions and of fabrics and other manufactures and works of art, patented or unpatented, which have been, or shall hereafter be deposited in said office. And said rooms or galleries shall be kept open during suitable hours for public inspection'. This provision applied to all models submitted with an application, including those that were ultimnately rejected and xxxxxed. Note relief in scientific American when these were ddiposed of.

[29] Although models mnot prior art, they were widely copied.

[30] 'The Commissioner of Patents is required by law to receive and keep in appropriate rooms all models of machines not patented, but awaiting their turn for examination. These models, by the uniform custom and usage of the Patent office, are kept in rooms appropriated for the purpose, to which no persons are permitted to have access except the proper officers of the Patent Office' (Letter from the Commissioner of Patents to the House of Representatives, March 13, 1848, Ex Doc 48, 30th Congress , 1st session, Room for the arrangemet fo models0.

represented and scrutinized. In many venues the immediate expressiveness of working models allowed them to eclipse textual and graphical descriptions of the invention:

> In many instances, the model is the test of the nature and extent of the invention and forms the rule by which subsequent improvements are ascertained and secured to inventors, for, although the specification is the legal evidence of the inventions, yet, many machines are so complicated that no one but a skillful artist can comprehend their construction or mode of operation without inspection of a model, and in all cases of dispute respecting the extent of improvement in the principles of original machines of any complexity, it is impossible for a court or jury to judge correctly without a model exhibiting the improvement.[31]

Models had the air of authenticity; they seemed to conserve the original integrity of the invention more entirely than any textual representation and more expressively than any drawing. It is true that from the second half of the nineteenth century onwards drawings gradually lost their pictorial quality[32] and acquired the capacity to communicate the workings of a machine in a standardized visual grammar.[33] But in a patent system focused on mechanical inventions and organized around adjudication (and more precisely the jury trial) patent models remained the most expressive means of representation.[34]

The persistence of patent models might also be attributable to the widespread use of models as means of instructing manufacture. It was obvious to Charles Babbage that this instructional role should be played by technical drawings:

> To produce movements even of a complicated kind is not difficult. There exist a great multitude of known contrivances for all the more usual purposes, and if the exertion of moderate power is the end of the mechanism to be contrived, it is possible to construct the

[31] Kendall J. Dood, part I, at p 205, citing an 1823 report of the Committee of Expenditures on the Patent Office.

[32] Following the destruction of the Patent Office in 1836, Reoper which lamented the loss of many xxxxs, including the drawings of the xxx, which were cie fcie A report on what was lost in the . As late as 1920s, an article by a exmnirer mportnat for drwings to be as complete as possible 'especially since models are no longer required, the drawings should fully illustrate the invention' (C.W.H. Brown, Patent Office drawings relating to applications' (1922-23) 5 JPOS 18-28, at 18. Also noted at 25 that might have to reproduce the model effect the problemfaced by the PO 'It has been held that it is not always practicable for the Examiner to point out in detail just what change would make the clearly illustrate the invention, so long as he has not before him some complete representation of the invention, such as a model, and that general objections thereto are sufficient to enable a skilled draftsman to cure the defect (at p 25).

[33] Ref rankin forthcvomign

[34] So one could ay that the scale model was more instructive thana scle drwawign because the size did not cokporimise visal display. In a case where reissue where the mode : 'Great importance, therefore, necessarily belongs to the model, which, in a device that, when reduced to the small scale used in the drawings, might be left in doubt, would furnish a distinct exhibition of the truth' (*Aultman* v *Holley* 11 Blatchf. 317, 2 F.Cas. 217, 223 (1873).

> whole machine upon paper, and to judge of the proper strength to be given to each part as well as to the frame-work which supports it, and also of its ultimate effect, long before a single part of it has been executed. In fact, all the contrivance, and all the improvements, ought to be made in the drawings.[35]

A drawing was like a paper prototype of a machine. As a near contemporary of Babbage put it: 'a machine that has been drawn is like an ideal realization of it, but in a material that costs little and is easier to handle than iron and steel'.[36] But for so long as Babbage's vision of industrial manufacture remained an ideal rather than a reality, technical drawings were not the predominant means of instruction. Ironically, Babbage himself failed to realize the design of his Difference Engine No2 precisely because it was so difficult then to convert paper machines into metal machines: 'Having conceived a machine some technical stages in advance of his era's power to manipulate metal, [Babbage] lacked a whole set of supporting technologies for the Engine, which was why he was constantly sidetracked by questions that had to be answered first, about alloys and temperatures and brass-turning equipment'.[37] The modern regime of industrial manufacture, based on the serial reproduction of artifacts from parts made to standard tolerances did not become established in the United States until the 1840s. Until advances in machine tools made paper fungible into metal[38] the reproduction of inventions depended on traditional mechanical craftsmanship and on the use of models as 'mediating physical instruments'.[39]

Besides their role in embodying novelty or instructing manufacture, mechanical models were also used to establish priority of invention. The patent act of 1839 allowed inventors a grace period of two years in which they could demonstrate the invention before taking out a patent, and without losing their priority over other inventors. An editorial in the *Scientific American* of 1847 advised its readers that models were the best proofs of the date of invention:

> The safest way is to construct a model – no matter how rough and simple, provided it embraces the principles and peculiarities – and exhibit it to your friends and request two or more of them to make a memorandum of the date; or, if practicable, write their names on the

[35] babbage, p 207. at p 208, the point that even this translation of drawings into have to be mechanical – the xxx:`The actual execution from working drawings is comparatively an easy task; provided always that good tools are employed and that methods of working are adopted, in which the perfection of the part constructed depends less on the personal skill of the workmen, than upon the certainty of the methods they employ'.

[36] Ferdinand Redtenbacher, *Prinzipien der Mechanik und des Maschinenbau* [1852], cited in Steven Lubar, `Representation and Power', (1995) xx *Technology & Culture* S54-S82, at p S70.

[37] Francis Spufford, 'The Difference Engine and *The Difference Engine*', in Francis Spufford & Jenny Uglow (eds), *Cultural Babbage. Technology, Time, and Invention* (London, Faber & Faber, 1996), 266-290, at p 267.

[38] See Joseph Wickham Roe, Tool Builders , esp at pp

[39] Alder making things the same, 511

model itself, adding the date. You may then exhibit it openly without danger, and may spend a year or more in improving and perfecting the invention.[40]

These models were rarely recycled as patent models.[41] Dood observes that when inventors came to file for a patent they usually submitted specially-made patent models rather than the models made for the purpose of protecting priority because 'the earlier models would not satisfy the Patent Office rules regarding size and durability'.[42] So an invention might be embodied in a succession of models, each appropriate to a particular stage of its career. Models made for demonstration were succeeded by models made for the Patent Office, which were in turn supplanted by copies made for litigation.

**After obsolescence**

By the 1850s the accumulation of models had begun to pose a real practical problem for the administration of the Patent Office. Although the Office collection was reduced by natural decay – models fall apart[43] – and more dramatically by catastrophes such as the fire of 1836 that destroyed the Patent Office building and some 7000 models,[44] and although the Office twice moved to larger premises, first in 1810 and then again in 1840, models still overwhelmed the space that was available to accommodate them. In 1858, the *Scientific American* warmly welcomed a legislative proposal to return models to unsuccessful applicants: 'The utility of this provision of the bill must be apparent to all. A very large space in the Patent Office is given up as a sort of receiving tomb for this class of models; they are in a state of wretched disorder – covered with dust and rust. Many of them cost much money to the applicants who would gladly receive them back, and they are certainly of no use to the Patent Office, as the drawings and specifications are retained for reference'.[45] This commentary also suggested the ultimate reason for the decline of the patent model – the evolution

[40] Scientific American volume 2 February 6 1847, p 155. The refernce ot one year or more was the rule introduced in 1839 allowing inventors a grace eriod of two years after disclosure without lioding their priority. Before this time, even the construction of a model was problematic. In the early days, 'inventors crowded the [model-maker's] shop when their work was being done, fearing, often with good reason, that someone might steal their novel ideas (Ray & Ray, The Art of Invebntion, at p 15).
rs Un Of course, the model was then the something.

[41] Cf sewing machines

[42] Dood, part II, at p 237.

[43] As early as 1822 the State Department and Congress approved a request made by William Thornton for funds to employ a specialist to maintain and repair the models held in the Patent Office.Thornton took this initiative in response to the damage caused when the entire stock of office models was moved from one building to another, but his proposal also invoked the need for ongoing maintenance and restoration of the patent office collectionOf course, models could become worn or xxxx, and in 1822 employed a to keeep models in repair (see The patent office pony, p 75).

[44] Ee the Ruggles report. 3000 of thse models reconstructed using evodence sypplied by patenteres and financed by a $100 000 from Congress.

[45] (Scientific American volume 13, no 29, 27 March 1858, p 229).

of drawings and textual descriptions that could embody inventions in a form that could be more widely communicated. The patent act of 1870 can be taken as a formal marker of the end of the era of the patent model; it reinstated the pre-1836 rule that models were to be submitted only when they were required by the Commissioner of Patents, and it went on to provide that the Commissioner should have the authority to return or otherwise dispose of models submitted with unsuccessful applications.[4647]. Inventors were persistent: they continued to submit models with their application documents, perhaps motivated by a concern that they would be disadvantaged if they failed to do so, but patent practice had moved on, away from models and towards texts and drawings.[48]

Although a second fire in 1877 destroyed about 76 000 models, there were still far too many models for the available space: '[B]y 1880, the Patent Office was inundated with models. All the storage and exhibition space was taken, and they were haphazardly placed on filing cabinets, desks, book shelves, under chairs, any available space'.[49] In 1892, the Commissioner of Patents called attention to this state of affairs and sought advice as to the legal propriety of disposing of surplus models in order to relieve pressure on space.[50] The following year, a first batch of surplus models, the contents of 227 model cases, was boxed up and transferred across Washington to the Union Building, and in 1904 these models were joined by a further batch of about 25 000 models. But this merely deferred the question of disposal. In 1906 Congress reduced the amount of money appropriated to the storage of surplus models from $19 500 to $10 000, which was sufficient to pay for only a few months rental of the floors of the Union Building occupied by boxed models, and required the Secretary of the Interior to proceed with disposal of the model collection.[51] So in July 1906 the Commissioner of Patents instructed a team of principal examiners to go to the Union Building and identify and tag all those models that were 'necessary to retain to keep intact the history or existing records and such other models as probably may be advisable to keep as references in the examination of pending or subsequent applications'.[52] Meanwhile, however, the patent bar had become aware of moves to dispose of Office models, and a delegation of attorneys promptly came to the Patent Office to register a protest. The attorneys complained that '[t]he models are as much part of the record as anything else, and the idea of disposing of any of them is as obnoxious to us as it would be to dispose of the patented files as waste paper'; they went on to observe that 'the law [relating to

[46] 1870 Act section 14.

[47] Walker estimated that models were called for in 'not more than one tenth of the cases that admit of representation thereby' (Walker, section 127). This statutory provision was buttressed by a Patent Office regulation of 1880 that tried to eliminate unwanted models by stipulating that models should be provided only where they were demanded by the examiner

[48] The exception perhaps being plants – note the model apples used in the early period of pomology

[49] The Art of Invention. Patent Models and their Makers, at p 10.

[50] See Senate report 158, 59th Congress, 'Appropriation for model exhibit of the Patent office' (1906), at p 1.

[51] The 1906 report.

[52] 1906 report

disposal] was passed without the patent profession having a hearing on the question', and threatened that 'if the models are disposed of to any considerable extent and in the course of a few months, as is very likely to happen, some manufacturer is sued upon a patent and finds it essential to have a certified copy of some model which is destroyed it is going to raise a great deal of severe criticism, which is going to be heard in Congress'.[53]

The Acting Commissioner of Patents was quick to adopt this argument; he wrote to the Secretary of the Interior to point out that models were not mere museum exhibits:

> The 157 000 models stored in the three floors of the Union Building [are] public records and not per se an exhibition of models placed there simply to amuse or instruct visitors; but they are as much a part of the public records of patents as are the drawings or specifications or any other part of the patented cases. They are very frequently called for to be used as evidence in United States courts in suits. It frequently happens that the drawings in the Patent Office do not disclose the subject-matter of the point in controversy between two or more rival contestants for the same invention. The model always does, and it has been found in numerous instances that thousands and thousands of dollars have been saved to patentees who have been sued for infringement by reason of such disclosures.[54]

The Patent Office was also quick to adopt the solution proposed by the patent attorneys: in the circumstances, faced with a choice between a reduced rent and no rent at all, surely the owners of the Union Building could be persuaded to accept a reduced rent for the remainder for the year? But this was not a lasting solution, and in 1908 the Patent Office was obliged to renew its plans for the disposal of the collection. In May 1908 a commission formed of the Secretary of the Interior, the Commissioner of Patents, and the Secretary of the Smithsonian was appointed to implement a plan for the disposal of models; the perceived urgency of the situation was such that disposal was required to be completed by January 1, 1909. The commission was to proceed by first selecting those models that it considered to be of historical value, and then disposing of the remainder 'by sale, gift, or otherwise'. In the event, just over 1000 models – 'chosen by someone who only knew or cared about sewing machines'[55] – were claimed by the Smithsonian, some 3000 models were sold at auction

[53] Ibid at p 8.

[54] Senate report pp 4-6, at p 5. Went on to say, at 5-6, that 'In the case of a suit in court, a model is called for and a sworn employee of this office is directed by the Commissioner of Patents to take this model to any court where it is called for, retaining it in his custody at all times, and upon its return bring it back to the Office. The expense is borne by the attorney or one of the parties to the suit'.

[55] The art of Invention, at p 10.

for a total of $62.18, [56] and the remaining 156 000 models were put back in storage on the basis that they might be essential to the determination of future infringement cases. As late as 1917, the Commissioner of Patent was still countering questions about the expense of storing these models with the argument that '[i]mportant property rights are even now being determined by recourse to these models'.[57] Finally, however, in 1925 it was decided to dispose of the collection once and for all; in a reprise of the procedure adopted in 1908, the Smithsonian claimed 2500 models, a further 2600 went to other museums or to inventors or their heirs, and in 1926 the remainder of the collection was bought – boxed and unseen – by Sir Henry Wellcome, who planned to establish a dedicated patent museum.[58] The collected boxes remained unopened through the years of the Depression, and when Wellcome died in 1936 the models were sold to an enterprising Broadway producer, who staged the opening of selected boxes as a kind of performance for which the public was charged an admission fee. Improbably, this plan had considerable initial success, but ultimately the enterprise failed eventually, and in 1942 the remaining models were acquired by an auctioneer, O. Rundle Gilbert, from whose collection are derived many of the models now in private hands or available at auction.

The era of the patent model broadly paralleled the age of mechanical invention: 'Patent models as three-dimensional representations that somehow embody a tangible arrangement of 'several parts' are by and large congruent with a discrete era in the history of invention. They are incidentally congruent with the rise of the railroads, the first complex mechanical 'system'; when the requirement [to submit models] was terminated the new systems world was the world of electricity, which not only was not mechanical, it was not even visible'.[59] But patent models also left an enduring legacy. Our hypothesis is that patent models played a decisive role in the evolution of the nineteenth century concept of mechanical invention. The working model allowed one to see a machine in action. In an infringement action, a patent model displayed what doctrine called a 'mode of operation'; that is, it displayed the machine as a mode of suspended animation, not in the sense of action held in a freeze frame but in the sense of action bracketed off from its effects. Strange as it may seem, this representation of machines allowed patent doctrine to resolve the intangible form of the invention into an object with the qualities of definition that were essential in order or something to be property. The visible operation of a machine was construed as its 'principle', which was the name that the patent statute gave to inventive part of a machine. Models were complicit in generating a

[56] Ray & Ray, *The Art of Invention*, at p 10.

[57] Letter from Thomas Ewing, Commissioner of Patents, to the Chief Clerk of the Department of the Interior, May 3, 1917, in House of repreenttaives Document 203, 65th Congress 1st session 'Removal and storage of Patent Office models'.

[58] The remainde r this paragraph is based on ray & ray, p 11.

[59] ('Patent Models: Symbols for an Era' 8-11, at p 11).

doctrinal figure of invention – the notion of machines as means in themselves – that survived into the form of the modern patent claim. More generally, patent models realized an archetype of invention that informed patent doctrine well into the twentieth century, and that served as a basic premise for early twentieth century arguments about the patentability of chemical inventions and plant inventions.

**Litigation machines**

Although it is easier to speak of 'patent models', our account is focused on what should more properly be called patent litigation models: models as they were deployed in infringement actions rather than models as means of patent administration. Although models were initially filed with the Patent Office, where they formed a material archive of prior art, it was only in the courtroom that scale models came to life as instruments of demonstration and argument. Although the first patent act had instituted a procedure of patent examination[60] this formula was abandoned in 1793, and until 1836 patent applications were not substantively examined in the Patent Office. Patent rights were jurisprudential artifacts.[61] Inventors received a presumptively valid patent as soon as they registered their invention, but registration was little more than a formality.[62] The validity of a patent was determined only when it was tested in an infringement action,[63] where the invention was usually represented by a patent model. Even after 1836, adjudication remained for some years the central forum for the construction, interpretation, and enforcement of patents. Models could make the

[60] Petitions from inventors were reviewed by a Patent Board composed of three senior members of the government, including Thomas Jefferson (see generally P.J. Federico, 18 jpos 1936 237

[61] Note the still current idea that patents are just a title to sue.

[62] The Patent Office was established in 1802 and the first Superintendent of Patents, William Thornton, attempted to regulate patent administration in quite idiosyncratic ways '[Thornton] viewed the patent system not so much as imbued with a public interest, but rather as a mechanism for rewarding legitimate inventors and protecting their rights. He was not averse to acting independently of statutory authority when he perceived such action as necessary to protect the interests of inventors. Nowhere was this more apparent than in his policy of keeping issued patents secret and in his informal caveat practice' (Edward C Walterscheid, 'Patents and Manufacturing in the Early Republic' (1998) 80 Journal of the Patent and Trademark Office 855-891, at p 856).Advised on the consistency with prior art, and scandal because had himself as co-inventor in rerutn for these servisec – the
refer to Thornton's rules of 1811, (1923) 6 JPOS 98. Ruggles 18 JPOS 853.

[63] In his letter on the proper goals of patent law, Thomas Jefferson suggested that the purpose of the reform of 1793 was, precisely, to restore adjudication to a central role: '[T]hese investigations occupying more time of the members of the board than they could spare from higher duties, the whole was turned over to the judiciary, to be matured into a system, under which every one might know when his actions were safe and lawful. Instead of refusing a patent in the first instance, as the board was authorized to do, the patent now issues of course, subject to be declared void on such principles as should be established by the courts of law' (Thomas Jefferson, The Writings of Thomas Jefferson, volume 13, at p 336. Went on to recognize that mistaken: This business, however, is but little analogous to their course of reading, since we might in vain: turn over all the lubberly volumes of the law to find a single ray which would lighten the path of the mechanic or the mathematician. It is more within the information of a board of academical professors; and a previous refusal of patent would better guard our citizens against harassment by lawsuits.

'prior art' present and comprehensible to jurors assessing the novelty of a purported invention,[64] but their central function was to show that a given machine was (or was not) an infringement of a patented device. Because they could materialize and articulate the different kinds of knowledge that were involved in the fabrication of patent rights – mechanical knowledge, legal doctrine, and the 'common sense' of jurors – models were a common medium of argument, and in demonstrations they animated, complicated, and in some sense eclipsed textual descriptions and drawings. Although this way of proving invention could seem quite primitive,[65] models remained the most effective way of eliciting inventions from machines.

A sense of the role that patent models played in the courtroom can be gleaned from the reports of infringement actions. The reports of the major patent cases decided by the Supreme Court in the course of the nineteenth century are particularly interesting, even if they say little about the ways in which demonstrations of models were integrated into argumentation.[66] For example, the reports of the first major Supreme Court case, *Evans* v *Eaton*, refer to the role played by models at all instances of the dispute, and the report of the 1822 proceedings before the Supreme Court records the plea made to the judges by Evans' attorney: '[I]nspect the models which I hold in my hands. Cannot any man, who has sufficient mechanical skill to make a Hopperboy, and understand its use, see at one glance in what these two machines differ from each other?'[67] Similarly, when the famous Telegraph Cases, which concerned the patents to Morse's telegraph, reached the Supreme Court, the majority judgment approached the problem of distinguishing Morse's invention from the alleged infringement by observing that 'it is difficult, perhaps impossible to discuss this part of the case, so as to be understood by anyone who has not a model before him, or perfectly familiar with the machinery and operations of the Telegraph'.[68] The report of the Court's decision in *Burr* v *Duryee* (1863), which was said by *The New York Times* to be 'the most important decision on patent law ever decided in the court',[69] records Justice Grier's reference to the 'large museum of exhibits in the shape of machines and models' presented to the court, and cites his observation that these models were 'absolutely necessary to give the court a proper understanding of the merits of the controversy'.[70] These

[64] For an example see *Whitney* v *Carter* 29 F.Cas. 1070 (1810).

[65] See the comments in Rice v Odell

[66] See, for example, the report of *Brooks* v *Fiske* 56 U.S. 212, 214 (1853) where the reporter observes that he was 'unable to give an intelligible explanation of the arguments of counsel' because the arguments were so dependent on the demonstration of patent models, and, in similar vein, the report of *McCormick* v *Talcott* 61 U.S. 402 (1857); one gathers a sense o fht ei, but bvious that the dimension here, but not clear in what I consists.

[67] (*Evans* v *Eaton* 20 U.S. 356, 415 (1822)

[68] O'Reilly v Morse 56 U.S. 62, 122 (1853).

[69]

[70] 68 U.S. 531, 532. Indeed, the entire industrial process that was in issue in the case was staged for the benefit of the court, and was referentially intewrleaved nto coulsel's argument, prompting Jutice Grier to observe (at 533) that 'No similar argument, perhaps was ever made in any court of law; nor could a case be explained in a manner more satisfactory'Of course, this makes no distinction between original models and models made expressly for the purposes of argument before

references to the representational effects of models are all the more interesting given that they emerge from the rarified context of a supreme appellate tribunal, in which demonstrations would have been witnessed by an audience of judges sitting without jurors, and in which the issues were characterized as questions of law rather than questions of fact.[71]

Indeed, although the usual rationale is that models worked because they appealed to jurors, they were also indispensable to judges. Giving evidence to a Congressional Committee on Patents in 1877, General Mortimer Leggett, who served as Commissioner of Patents from 1871 to 1874 before returning to practice as a patent attorney, reported his experience of a trial into which he had gone thinking that he had, as he put it, 'a perfect case, one that could not be wrenched from me'. But his opponent, 'one of the best mechanical lawyers in the country', argued his case so effectively, and entirely on the basis of drawings rather than a model, that at the close of his argument Leggett felt somewhat dispirited. The same evening, however, the trial judge called Leggett to his hotel room and confessed that he had understood nothing of the entire argument because it had been based on the drawings rather than the model. Leggett reported the judge as saying 'I cannot understand the drawing; they are just straight lines on paper. I cannot see any machine on it at all'. Leggett called for the model from the courtroom and, together with his opponent, used the model to explain the principle of the machine: 'We spent about half an hour in explaining it to the judge, and he said that it was just as clear to him as a thing could be'. Some judges could read texts and drawings; for them, the drawing would 'stand up and be a machine'. But these were the exceptions: 'there is not to exceed one in five, at most, and probably not so large a proportion, of our best judges on the bench who get any just conception of a machine by the drawing'. So, according to Leggett, 'the only way to avoid confusion and difficulty is to have the model itself from the Patent Office, or a certified copy of it that shall be an exact copy'.[72] The premise of Leggett's account was that models were less open to interpretation than texts or drawings; in response to the question asked by one member of the committee – 'Would not forty experts come and give the testimony differently in regard to the same model?' – he affirmed that where drawings introduced confusion a model admitted of only one interpretation. But the very structure of an infringement action was such that were radically different arguments as to the meaning of mechanical form, and models were necessarily implicated in these arguments.

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the court – the erusl piginal jis

[71] In one such case, observed that deomstration fo models to the Supreme Court, the although not 'proper' for the Court 'to express any opinion on what is really a matter of fact', that the examination of the models enabled the court to satisfy itself as to the conclusion the fairness of the jury's conclusions lower down (se *Silsby* v *Foote* 55 U.S. 218, 226 (1852)).

[72] See Arguments before the Committee on Patents April 3rd 1878, 45th Congress 2d Session Mis Doc 50, at pp 99-100.

The 'large museum' of models referred to in the decision of the Supreme Court in *Burr* v *Duryee* was probably composed of a variety of models. Although the Model Room was open to the public, patent models rarely traveled,[73] so the models demonstrated in infringement actions were either certified copies of the model held in the Patent Office or models constructed especially for litigation. All mechanical inventions patented between 1836 and 1870 would have been embodied in a Patent Office model, but these models were often joined by others. But although it seems reasonable to suppose that questions about the authenticity of models must have arisen,[74] there are few traces in the reported cases. One example is a late nineteenth-century Supreme Court decision in which the question was whether a patent reissued in 1876 for a balancing spring mechanism for railway carriages was anticipated by an 1861 patent. A number of models of the 1861 invention were entered as evidence, and Justice Brown observed that although one model in particular (presumably submitted by the defendant) suggested that the invention was disclosed in the older patent it did so 'by its peculiar construction in shortening the links and strengthening and stiffening the entire structure'.[75] By contrast, the certified copy of the Patent Office model did not have this feature. Only in 1877 was a proposal made to formalize the status of certified copies of the Office model as admissible evidence in infringement actions, and the argument advanced in 1906 by the patent bar against the disposal of the collection of Patent Office models suggests that it was by then the established practice to have certified copies of Office models made for the purposes of litigation. The procedure then suggested by the Acting Commissioner – an employee of the Patent Office, acting under oath, might be 'directed by the Commissioner of Patents to take [a] model to any court where it [was] called for, retaining it in his custody at all times, and upon its return bring it back to the Office'[76] – would have been expensive and therefore, presumably, rarely employed.

**What is a model?**

Patent models were species within a broader genus. In the nineteenth century – the century of the scientific model[77] – representational models took center stage in a variety of institutional settings: scientific laboratories, lecture theatres, museums, and administrative bureaus. These models differed

[73] The Officnce model could be dispatched, but only in th ecustory of an Ofice employee and with the xx of the xxx.Ref patent office pony on the xxx.

[74] ('[W]hen a model was introduced into court proceedings to help interpret a written description, the question might still have arisen whether the model and the description represented the same thing, or whether the model itself was based on an interpretation of the description designed to further the patentee's cause rather than the cause of justice' (Kendall J Dood, part I, at 205).

[75] *Topliff* v *Topliff* 145 U.S. 156, 161(1891).

[76] See footnote xx

[77] See generally the contributions to Soraya de Chadarevian & Nick Hopwood, *Models. The Third Dimension of Science* (Stanford: Stanford University Press, 2004).

greatly in their form and effect: in form, they could be conceptual, graphical, material, or mechanical; in effect, they could represent, memorize, analogize or make portable, or they could do all of these things at once. Anything could be taken as a model: a chemical formula or 'paper tool';[78] a rigid sculpture of spheres and connectors; an experimental engine such as William Crookes' radiometer. Yet, although the nineteenth century was the century in which models came to the forefront of scientific practice, it was not until the late twentieth century that they found effective theoretical expression. This might be taken as a provocative assertion, given that philosophical reflection on the role of models goes back at least to William Whewell;[79] for our purposes, however, what is interesting is not the classical epistemological or philosophical rationalization of scientific practice but the approach developed by studies of science in action: how should we trace out the assemblage of gestures, inscriptions and materialities through which scientific knowledge is fabricated, cultured and transferred?[80] From this perspective models are models twice over: for their users, they are instruments for eliciting or communicating scientific knowledge; for the ethnographic or historical observer the first-order user of the model is him- or herself a vector, relay or irritant[81] whose agency cannot be explained in instrumental terms. The reason for contextualizing patent models in the broader genus of nineteenth-century models is not to suggest that there might be a general theory of models: even in science models used in biology are quite different from those used in physics.[82] Rather, the point is that the epistemic functions of patent models should be construed as a specific inflection of more generalized procedures of cognitive fabrication.

To what extent does the function of patent models actually need theoretical elaboration? Patent models were scale reductions, which are commonly seen as the most naïve form of representational model. In fact, perhaps patent models did not 'represent' at all. Mario Biagioli observes that the models that were used to represent the inventions protected by early modern privileges were just 'presentations': 'When a model was entered as evidence of the claim to be covered by the privilege, it functioned (in that context) as the invention itself – it presented the invention'.[83] Perhaps patent models functioned in a similar way: they were just a convenient means of 'presenting' artifacts that were too large or cumbersome to be brought into the court room in life size. If that is so, then what

[78] See Ursula J Klein

[79] Perhaps further if one counts (say) Vitruvius's reflection on the the modelus.

[80] The literature here is well known; highlights include: Latour & Woolgar, Laboratory Life, Hans-Jorg Rheinberger Karin Knorr-Cetina, Peter galison

[81] See generally latour

[82] On this point see Peter Godfrey-Smith, 'The strategy of model-based science' (2006) 21 *Biology and Philosophy* 725-740., which opens (at 725) with the observation that '[t]he term "model" is surely one of the most contested in all of philosophy of science'.

[83] See Biagioli, Patent republic. On the . '[A] model was not just a copy of an invention. The distinction between model and machine was not one of copy to original, but just one of scale. Models don't have originals. We cannot say whether the "original" was the machine or the model, or whether the model was scaled-down or the machine scaled-up'.

Biagioli says of the 'privilege model' might also be said of the patent model: '[A] model was not just a copy of an invention. The distinction between model and machine was not one of copy to original, but just one of scale. Models don't have originals. We cannot say whether the "original" was the machine or the model, or whether the model was scaled-down or the machine scaled-up'.[84] Unlike privilege models, however, patent models were demonstrated to audiences that had learned to see through the material form of a machine or model to the intangible idea that it embodied.[85] Colloquially, the 'invention' was the material machine, but for patent jurisprudence it was the intangible design that informed the material artifact.[86] It may be that ideas truly became things distinct from their embodiments only later in the nineteenth century, when inventions could be entirely fixed in text,[87] but demonstrations of patent models anticipated this development: they too were designed to make the difference between idea and embodiment. Representation was imagined as radiography – seeing through a material artifact to its inventive principle. So the peculiarity of the patent model, by contrast with the privilege model, was that the 'thing itself' was not so much a thing as a relation made material: the model was at once the representation and the thing represented, sign and object.

The nature of this relation can be explored by way of a detour through debates about the character of scientific models. In his collection of essays on the subject Marx Wartofsky proposed to do away with what he called the 'model muddle'; the point was to 'collapse the distinction between models, theories, analogies, and to take all these, and more besides, as species of the genus representation; and to take representation in the most direct sense of image or copy'.[88] Wartofsky went on to observe that 'although it is the case that anything may be taken as a model of anything else, it is being taken as a model which makes an actual out of a potential model; and every case of being taken as a model involves a restriction with respect to properties'.[89] What is involved in 'taking' something as a model? It may be that the factors that prompted Wartofsky to absorb models, analogies and theories into a broad category of representation should instead be taken as reasons for disposing of the simple notion of representation as 'image or copy'.

To begin with, if models emerge when they are 'taken' as such then the materiality and agency of a model has less to do with intrinsic properties than with the way that strategic transactions mobilize, inflect, and hold steady a ramified network of representational competences and resources. If

[84] Ref. Certainly tue nthe sense that model was part ofa biography of which these relations are smply interruptions.
[85] As Biagioli puts it
[86] Boulton & Watt v Bull – the equivocation here
[87] Biagioli again
[88] Wartofsky at p 1.
[89] Marx Wartofsky, *Models: Representation and the Scientific Understanding* (Dordrecht: Dordrecht Reidel, 1979), at p 6.

models seem to have properties then these are an effect of 'saturation'[90] by discursive strategy. So the question to ask of a model 'cannot be "what does it represent?", but rather must be about how it is involved in acts of representation and what meanings these produce'.[91] In the case of mathematical models, for example, the agency of the model has to be referred the 'intricate web of meanings [woven] by imagined, immaterial things like blackboards, chalk marks, and plaster objects, as well as by material processes like talking, writing, drawing, and gesturing'.[92] This makes sense in the case of patent models. Some patent models did not even have the slight complication of scale: inventors of smaller artifacts – notably locks and sewing machines[93] – fulfilled the requirement of the 1836 statute by depositing an exemplar of the manufactured artifact with the patent application.[94] Why submit a model when the machine was small enough to be its own model? But what is interesting is precisely the idea of a thing being its own model. A sewing machine submitted as a model was not just another serial exemplar of the artifact; once deployed as a model, it was (re)animated by a network of representational elements and demonstrational techniques.[95] To take something as a model is to shift it from one phenomenological horizon or discursive network to another, and 'scaling down' – or even 'scaling up'[96] – is just one means by which this displacement is effected.

However difficult it might be to renounce the word,[97] 'representation' is not the best name for these epistemic transactions. The form of the representational relation – the frame defined by the distinction between original and copy, or prototype and exemplar[98] – does not explain the process of taking something as a model. One cannot begin with(in) this frame – the terms of object and sign – and construe epistemic transactions as the means (psychological, sociological, or semiotic) by which each of these poles is relayed to the other. Models fabricate representations, but any representation is

[90] For this sense of saturation see Fouculat

[91] Herbert Mehrtens, 'Mathematical models', in Soraya de Chadarevian & Nick Hopwood, *Models. The Third Dimension of Science* (Stanford: Stanford University Press, 2004), 276-306, at p 284.

[92] Loc cit.

[93] See Grace Rogers Cooper, *The Sewing machine: its invention and development*, digital edition (The Simthsonian Institution, 2004), available at: http://www.sil.si.edu/digitalcollections/hst/cooper/

[94] refs

[95] (and, importantly for our purposes, the patent office and the courtroom brought quite different networks into play).

[96] In the other direction, doctrine that scaling up was just a of the same thing: 'the enlargement of the organization of [a] machine compared with [an] old one [does not] afford any ground, in the sense of patent law, for a patent. This is done every day by the ordinary mechanic in making a working machine from the patent model' (*Phillips* v *Page* 65 U.S. 164, 167 (1860)). This denies the problems with the xten and transformation nf an idea. Note also the idea that a model – even a model 'exhibiting the article in all its parts, disclosing its mode of operation and clearly showing its feasibility' (Wiliam C Robinson, The Law of Patents for Useful Inventions (1890), at p 182) – could not count as a reduction to practice of the invention. And this is teue even thoeugh the inventor could employ another to build from th emoel – to reduce to praccie fpr h – thje inventor and the mecaniscThe mnbeunt as a R owas not a recution to practice – that the could

[97] So, for example, the rhetorical form of Bruno Latour's critique of the assumption that one can have 'representation without any re-presentation, without any provisional assertions, without any imperfect proof, without any opaque layers of translations, transmissions, betrayals, without any complicated machinery of assembly, delegation, proof, argumentations, negotiation and conclusion' (Bruno Latour, at p xxx).

[98] Which is already a highly selective take on what repreasentatio might mesn- see Focualt and others ofn this – the al

just a productive interruption of a process in which representations connect to other representations, not to 'reality': 'The process of modeling is one of shuttling back and forth between different spaces of representation. Scientific objects come into existence by comparing, displacing, marginalizing, hybridizing and grafting different representations with, from, against, and upon each other'.[99] What does this mean in he case of patent models? To begin with we have to re-imagine the materiality of models. Models have to be scaled up, not in the sense that they should be referred back to the machines that they were supposed to (re)present, but in the sense that their material form has to be expanded and diffused back into the capillary network of knowledge, know-how and communicative forms that was essential to their operation. With models as with anything else, materiality is sociality;[100] the specific materiality of a model is the effect of a particular disposition of semantic forms, communicative competences, and material instruments.

**Models as media**

Of course, there was something to the naïve apprehension of models as things. Lawyers, inventors and administrators took to models precisely because they were material objects; the abstract form of the invention was held in a tangible object that could be archived, examined, operated, dismantled, or held up to another model, all so as to get at the inventive principle that it embodied. But what is important here is, once again, the fact that patent lawyers took models not as representations of machines but as representations of inventions embodied in machines. Lawyers might not always have found it easy to practice this difference. In 1818, commenting on a particularly involved demonstration of mechanical form, Judge Story took patent lawyers to task for turning infringement cases into lessons in mechanical science: 'the question whether the principles are the same in two machines, is in reality, when all the facts are given, rather a matter of law, than of the opinion of mechanics; at least matter of law is necessarily mixed up with it, which mechanics could not be presumed to be acquainted with'.[101] Story's point was that lawyers should demonstrate mechanical form or draw on the 'opinion of mechanics' only for the purposes of revealing the inventive 'principle' of a machine, which was 'a matter of law'. The sensible, tangible, substance of a model was to be taken as the embodiment of a form that could be visualized only by the legal imagination. Story's insistence on the difference between mechanical knowledge and legal knowledge is of crucial

[99] Hans-Jörg Rheinberger, *Toward a History of Epistemic Things. Synthesizing Proteins in the Test Tube* (Stanford: Stanford University Press, 1997), at p 108.

[100] For one version of this see Bruno Latour & Vincent Antonin Lépinay, *L'économie, science des intérêts passionés* (Paris: La Découverte, 2008), at p 47.

[101] Barrett v Hall 2, F. Cas. 914, 923, (C.C.D. Mass. 1818).

significance, but for now there is a preliminary question: how should we construe the doctrinal understanding of embodiment?[102]

For patent doctrine embodiment was just a special case of representation: nothing about the jurisprudential understanding of models, texts and drawings as (radiographic) images of invention is inconsistent with the Wartofsky's account of models as representations – as images or copies. The only peculiarity was that the thing represented was the intangible shadow of its material image. One line of argument in the philosophy of science suggests that embodiment is not only a special case of representation but a phenomenon that is actually central to any explanation of how models function in scientific practice. This twist to the analogy between patent models and scientific models is interesting because it concentrates attention on the most essential characteristic of patent models – their role as embodiments – but also because the philosophical account of how scientific models function as embodiments points beyond itself to a quite different sense of embodiment as a medium of discursive fabrication.

Wartofsky observes that '[scientific] models are systematic, and [a] minimum or sufficient condition for something to be a model is that it postulate in some systematic way not merely entities, but feasible relations among them'.[103] So the essential vocation of scientific models is to elicit the logical, mathematical or causal patterns that structure phenomena in the real world.[104] According to a specific variation on this approach scientific models are just abstract formulae – artifacts of mathematical logic – and they function as representations because this ideal or logical structure is isomorphic to the structure that is ascribed to the real world. On this view, 'the sense of "model" that is applied is either the logician's sense, or something relevantly close to it'.[105] The point of scientific modeling is not to generate a phenomenally or descriptively rich picture of the world but only provide 'an interpreting structure for a set of sentences',[106] and any structure of which that set of sentences is true counts as a model.[107] The limitations of this formalistic analysis of scientific practice have been

[102] Ignoring for now the sense in which – as a matter of epistemic logic – first-order perspectives always come after their observation at second order See Luhmann

[103] Wartofsky, at p 28.

[104] This is a broad – perhaps excessively broad – stam of the science, which ragnges from the idea of th – throght e models as mediatrs and xxz.

[105] Peter Godfrey-Smith, 'The strategy of model-based science' (2006) 21 Biology and Philosophy 725-740, at 727.

[106] 'A model, basically, is a set of objects (and relations between them) that functions as an interpreting structure for a set of sentences. A model is used as something for a set of sentences to be true of' (Godfrey-Smith at 727, summarizing the semantic view of modelling).

[107] See Roman Frigg, 'Scientific models' in Sahotra Sarkar & Jessica Pfeifer (eds), *The Philosophy of Science. An Encyclopaedia* (London: Routledge, 2006) vol 2, 740-749,. at p 743: 'In modern logic, a model is a structure that makes all sentences of a theory true, where a theory is taken to be a set of sentences in a formal language, and a structure a set of object along with the relations in which they enter. The structure represents the abstract theory in the sense that it interprets it and provides an object the embodies its essential features'.

widely canvassed, and we introduce it only so as to get at the theory of scientific models as embodiments. Critics of formalism point out that if models were just isomorphic set-theoretic formulae they would be too abstract to represent anything in the real world. Precisely because they are formal abstractions structures are 'multiply realizable': if the same mathematical formula can legitimately be ascribed to a number of quite different phenomena then the bare formula is just too indifferent to the real texture of the world to be able to distinguish, identify and 'represent' phenomena.[108] Indeed the point of modeling in scientific practice is precisely to generate this kind of descriptive contextualization: '[M]odels are essential to theory. Without them there is just abstract mathematical structure, formulae with holes in them, bearing no relation to reality'.[109] So even if we say that models represent by disclosing causal or logical patterns,[110] they do so by framing these structural patterns as simplifications of real phenomena and by giving a sense of what it is that is being simplified.

This brings us to embodiment. In an old discussion of scientific models Henry Byerly develops – or perhaps anticipates – the argument that there is necessarily more to a model than 'structure'. Acknowledging that the relationship between a model and that which is modeled 'always involves similarity',[111] Byerly points out that a model must nevertheless be something more than an isomorphic echo of the target phenomenon. The model has to supplement, enrich or contextualize the structure that it elicits so as, precisely, to identify that structure as the structure of something. In practice, according to Byerly, models achieve this because they unite two dimensions that can be separated out by distinguishing 'model-objects' from 'model-structures':

> A model-object may be idealized, but it will always have a descriptive (non-logical) content. A model-structure, on the other hand, is a definitely specifiable schema of mathematical-logical relationships.[112]

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[108] For a useful exposition of the problem see Roman Frigg, 'Scientific representation and the semantic view of theories' (2006) 55 *Theoria* 49-65, esp at p 56: '[C]onsider ordinary medium-size physical objects. A minimal condition for such a thing to be an individual is that it occupies a certain space-time region. For this to be the case it must have a surface with a shape that sets it off from its environment. This surface in turn is defined by properties such as impenetrability, visibility, having a certain texture, etc. If we change scale, other properties may become relevant; but in principle nothing changes: we need certain more concrete properties to obtain in order for something to be an individual'. See further the specific example of the structure of methane molecules at pp 57-58.

[109] Nancy Cartwright, *How the Laws of Physics Lie* (Oxford: Oxford University Press, 1983) at p 159. On this view, models are not (necessarily) structures.

[110] Which raies the question whether rthi sis what explanation si ro whether rit is something different – see genrally Cartwright.

[111] Byerly at p 140.

[112] Henry Byerly, 'Model-structures and model-objects' (1969) 20 *British Journal for the Philosophy of Science* 135-144, at 136.

There is symmetry between the model and the target phenomenon because the form of the model-structure appears twice over, once as the 'significant structure'[113] that scientific explanations seeks to elicit from a real world phenomenon and then again as a dimension of the 'model-object' – the ideal or material form that is 'taken as' a model. The model-object has a descriptive or phenomenal richness that a bare mathematical-logical structure does not; held in its model embodiment the mathematical formula becomes specifiable as the structure of some identifiable phenomenon. For Byerly this added richness matters because the real point of scientific explanation is to disclose causal relations, and one can only do so by adding phenomenal form to theoretical abstraction.[114] The relation between the two dimensions of a model is such that 'the model-object "carries" as it were the logical-mathematical structure of the model-structure'.[115] What is involved in 'carrying'? In a somewhat cryptic elaboration Byerly observes that the relation between the logical and the descriptive is 'the old form-matter distinction in its modern reformulation'.[116]

The old (Aristotelian) distinction between form and matter has remained such a persistent figure of thought because it is an evident and yet elusive distinction. The equivocal quality of form – is form the inner architecture of an artifact or organism or its manifest shape? – is itself an effect of form's equivocal relation to matter: for Aristotle, form was actualized only in its material expressions or embodiments, and matter could be identified only in the guise of some form.[117] So in any organism or artifact – or material model – form and matter are distinct but effectively indistinguishable. Matter is so saturated with form, and vice versa, that difference between the two dimensions is always an effect of observation. So if in Byerly's terms the model-object plays matter to the model-structure's form, then the difference between the representation and the thing represented does not exist until the terms are distinguished – and thereby called into being – by some constructive observation. Embodiment is not so much a special case of representation as a medium from which relations of 'representation' are fabricated. Byerly goes some way in this direction with the suggestion that each of the different model-objects or domains of interpretation in which a single model-structure might be 'carried' will yield a different iteration of that structure, or a different patterning of causal

[113] Byerly at 136.

[114] 'To explain is to bring out logical relationships, even if scientific explanation may well not always consist in straightforward inferences. But then there is always a "that which" is logically related, and this is not just empty structures. …Causal relationships, in any plausible use of 'causal', require descriptive content. We use causal relationships among characteristics of model-objects to suggest lawlike relationships among characteristics imputed to theoretical entities' (Byerly, at pp 143-144)

[115] Byerly, at 136

[116] Byerly, at 136 and 137, respectively.

[117] On the persistence of the Aritstolte as the classical tradition see Norma J. Emerton, The Scientific Form (Ithaca: Cornell niversity Press, 19xx). For cptemporaneity, see Bensaude-Vincent. For Aristotle matter was not just a mute medium into which form was impressed or infused; even before it was formed into an artifact or organism matter already tended towards its actualization. so that one could say that the finished form of an organism or artifact wasl already potentially, or virtually, presen tin its mateial substance:].

relations.[118] Even (or perhaps especially) in the case of a highly formalized mathematical abstraction, form is specified and constituted by the medium in which it is carried or expressed. But this does not get at the essential difference between 'embodiment' as a theme internal to doctrine and embodiment as a condition or medium of discursive practice. In the philosophy of science the constructive role of models is acknowledged (but contained) by locating models in the middle of representation. So, for example, Nancy Cartwright proposes a 'simulacrum' view of representation, according to which models are the means by which 'we construct both the theories and the objects to which they apply, then match them piecemeal onto real situations'.[119] On one side, theoretical statements are true of models, not of the world; on the other, models elaborate a 'prepared description' of the world, or a selective account that disposes the world to accept a theoretical proposition: '[W]hen we present a model of a phenomenon, we prepare the description of the phenomenon in just the right way to make a law apply to it'.[120] So models mediate representation, and mediation is a constructive process,[121] but it is still framed by representation. That is not how patent models worked.

**Fabrication**

Patent models were not mediators: they were media from and in which the discursive form of the invention was fabricated. In the course of demonstration a patent model machined various epistemic resources – patent doctrine as it was expressed in the expectations and interventions of lawyers and judges, testimony as to the significance of mechanical features, paper tools (patent texts and

[118] See Byerly 139-140. Byerly takes the example of the kinetic theory of gases, which features at least three distinct model-objects: the gas molecules themselves, or rather a theoretical representation of molecules and their attributes, the analogue model of colliding billiard balls, which represents the collision of particles in random motion, and the macroscopic volume of gases, which models kinetic processes by correlating the pressures, volumes and temperatures of specimens of gases (at 138). These three model-objects overlap in interesting ways. The analogue model of colliding billiard balls generates a model-structure that is replicated into the other two model-objects,[1] so that a single model-structure acquires alternative 'domains of interpretation' (at 140).

[119] Cartwright at 162.

[120] Nancy Cartwright, *How the Laws of Physics Lie* (Oxford: Oxford University Press, 1983) at p 157

[121] For example, according to the so-called 'model-based' view of scientific theories, theories can be reduced to statements containing predicates, and these predicates do not refer to the world directly but by way of models (see Ronald N. Giere, *Science Without Laws* (Chicago: University of Chicago Press, 1999), esp chapter 6). So, for example, the word 'pendulum' does not directly refer to anything like a pendulum in the real world; rather, it refers to a family of idealized model pendulums that function as 'prototypes' against which one can identify central or peripheral cases of things like pendulums in the real world. As Giere puts it, 'a model functions as a predicate, as a model of a pendulum gives content to the predicate "pendulum" in the open sentence "X is a pendulum"' (at p 100). Constructive because There are no entities that would exist in the real world independently of the schematization immanent in a model or prototype; there are only schematizations that 'work'. So one might say, glossing Thomas Kuhn's observation that that there were no pendula in the world until Galileo had conceived of the , the the xx te space of reprsentation: '[F]rom Galileo on the worlds of natural philosophers and physicists include abstract pendula of all various masses and string lengths. And with these in the mental space of the scientist, the world looks very different because many physical objects approximate the properties of an ideal pendulum so that prediction is possible and fruitful' (Richard Grandy, 'Thomas Kuhn', in Sahotra Sarkar & Jessica Pfeifer (eds), *The Philosophy of Science. An Encyclopaedia* (London: Routledge, 2006) vol 1, 419-432, at p 428).

drawings), the sensibilities of jurors, the expressivity of a scaled-down mechanism – into a discursive phenomenon – the invention – that could be written into doctrine and carried forward as a warrant of validity, which might in turn be challenged on appeal, factored into negotiations with competitors, or added to the balance sheet of a business. There is a difference between scientific models and jurisprudential models: patent models were not designed to prove a theory but to vindicate a claim to property. So, although the demonstration of scientific models is also a rhetorical process with normative effects,[122] patent litigation intensified these effects by staging a confrontation between two models, or between two antagonistic demonstrations of the same model, each of which 'scaled up' the materiality of the model in quite different ways. And these antagonistic demonstrations were really fabrications rather than alternative 'interpretations'. Patent models did not relay signs to things, or mediate a relation between word and world; they quite simply made (the difference between) sign and thing. Taken seriously, more seriously than Byerly might have intended, the 'old form-matter distinction' is an especially apposite figure for understanding how patent models fabricated invention.

For Aristotle, matter and form were just two of four causes (material cause, efficient cause, formal cause and final cause) and the production of any artifact depended on the co-operation of all four; and, just as the distinction between form and matter is an effect of observation, so too is any differentiation of the respective contributions of these four causes.[123] Crucially, different weightings or permutations of the four co-operating causes will yield very different biographies of the same artifact. Depending on the perspective or interest of the observer, emphases will shift across the spectrum of design, manufacture, material specificity and utility so as to fashion different genetic accounts of the artifact. In an important sense, artifacts are remade by their observation. Indeed, remaking – invention or fabrication – might be said to happen twice over: a substance or artifact can be re-engineered either materially or discursively. This point is essential to understanding the role of patent models in fabricating invention.

The notion of invention as re-engineering – or modulation – emerges from Bernadette Bensaude-Vincent's return to Aristotle's causal schema as a means of explaining invention in contemporary material sciences. In technological fields such as carbon fiber research the raw material is continually re-engineered so that it is 'no longer a material in the sense of matter that can be molded, but is instead a modulable object'.[124] Since the 1970s, innovations in the construction of carbon fiber as a composite material have exploited the anisotropic character of the material: rather like wood, the

[122] Ref Shaffer

[123] One might say that matter – or material cause – was just one of many 'virtualities tending towards an end'. (paraphrasing Bensaude-Vincent's descriptin of matter in trms of a set of '*virtualites tendues vers l'accomplissement*' (at p 82).

[124] B-V, at p 187.

properties of carbon fiber are dependent on the grain of the fiber. New forms of carbon fiber are fashioned by superimposing multiple layers of resin-impregnated fiber, each with a differently-oriented 'grain', and by curing the new structure in a pressurized autoclave: 'in this way, the topology of the material is constructed by successive folds'.[125] The material becomes the simplest kind of combinatory, in which the addition of the same substance to itself creates complexity through involution. Whereas the conventional legal-economic representation of innovation orders the four causes into a linear progression, leading from natural structures to properties, and from properties to industrial functions, Bensaude-Vincent describes a mode of invention in which the various facets of a material – structure, property, function – are ongoingly and simultaneously 'qualified' (to borrow the tem used in patent doctrine) by each other. So, for example, although the process of forming a new composite material seems to be governed by function or utility – materials are made to fit a purpose – the return to a raw material in search of new properties leads to the discovery of new structures with properties that suggest new utilities, and so on. Matter is continually being 'informed' anew, it continually gains new potentialities, so that invention is the ongoing renewal of the old.

The idea of invention as an effect of permutation, modulation, or recombination was made explicit quite early on in the history of patent doctrine. As early as 1814, it was observed in one infringement action that '[i]n the present improved state of mechanics, the same elements of motion, and the same powers, must be employed in almost all machines. The lever, the wheel, and the screw, are powers well known… The material question, therefore, [in determining whether a new device embodied a patentable invention] is not whether the same elements of motion, or the same component parts are used, but whether the given effect is produced substantially by the same mode of operation, and the same combination of powers, in both machines'.[126] This notion of invention as a novel 'combination of powers' became more refined as mechanical inventions became more complex and as markets became more extensive and potentially more lucrative. The basic doctrinal premise was that an invention was a novel articulation of known parts: 'a combination may be defined to be a co-ordination of individual functions, so as to constitute a common function. Co-ordination necessarily implies some modification of the individual function of each part as it existed prior to the combination'.[127] In patent jurisprudence, 'combinations' were distinguished from 'aggregations'. Whereas an aggregation was a non-transformative composition of elements, which elicited nothing novel from its parts, a combination was patentable because it brought into action

[125] B-V, at p 182.
[126] Odiorne v Winkley 18 F.Cas. 581, 582 (1814). See also *Goodyear Dental Vulcanite Co* v *Smith* (1874): 'Strictly speaking, no new manufacture is anything more than a new combination and arrangement of old materials'.
[127] Ex parte Marshall (1883), cited in Robinson, vol 1, at p 216-217.

'some new or as yet unawakened energy':[128] accordingly, a mere 'juxtaposition' was to be distinguished from a 'vital union',[129] and one could not have a patent for 'a mere aggregate of several results, each the complete product of one of the combined elements'.[130] In an aggregate, apparently, the collected elements were unaffected by each other, so that each continued to have the effect it would have had in isolation, whereas in a combination all elements were supposed to be mutually involved with and transformative of each other: '[a]ll the component parts must so enter into a combination of old elements, that each qualifies every other'.[131]

How was this process of mutual 'qualification' to be explained? Conservatively, one could say that novel effects were just the result of mechanical co-ordination, as in the example of the sewing machine, 'where one part advances the cloth, and another part forms the stitches, the action being simultaneous in carrying on a continuous sewing'.[132] Here, it seemed, each of the component elements retained its 'original' identity within a process of co-action,[133] and the 'whole' invention was an effect of the permutation of the competences proper to these original identities. But this understanding went hand in hand with the more expansive notion suggested by the reference to an 'unawakened energy', which pointed to something more like an effect of chemical synergy, as exemplified in the process of vulcanization: when sulphur was mixed with rubber 'the combination of the two produced a result or an article entirely different from that before in use'.[134] The analogy to chemical reactions shifted the focus from elements to the product of their combination, and the image of chemical reactions as synergistic processes emphasized the creative act of bringing components together: the invention lay in the (act of) relation, and the identities of the components were relative and emergent rather than inherent and predetermined. The more expansive idea of combination imagined a whole that was more than the sum of its parts, a whole that yielded 'effects beyond the sum of the effects producible by all the elements in their separated state'.[135] And this in turn implied a new way of imagining the parts of the combination; instead of being elements or quantities with pre-determined properties or competences, they were imagined as variable terms with competences that emerged from their engagement with other elements.

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[128] Robinson, vol 1, at p 228.
[129] Pickering v McCullough 104 U.S. 310, 318 (1883).
[130] Reckendorfer v Faber 92 U.S. 347, 353 (1875).
[131] Identical wording in Pickering v McCullough 104 U.S. 310, 318 (1883), and Clark Pomace Holder Co. v Ferguson 17 Fed.Rep. 79, 80 (1883).
[132] Reckendorfer v Faber 92 U.S. 347, 357 (1875).
[133] 'While every element remains a unit, retaining its own individuality and identity as a complete and operative means, their combination embodies an entirely new idea of means, and thus becomes another unit, whose essential attributes depend on the co-operative union of the elements of which it is composed' (William C Robinson, vol 1, at pp 220-221.
[134] Reckenbacker v faber 92 U.S. 347, 357 (1875).
[135] Robinson, vol 1, at p 225.

**Two models in one**

Invention happened twice over: because inventions were theorized as combinations, 'combination' necessarily became the effect that had to be demonstrated or (re)enacted within the trial process. In that sense, perhaps, models actually were 'presentations' of machines; in its scaled-down presentation, a mechanical artifact could be discursively anatomized and reconstituted so as to elicit the principle by which its elements were combined. Of course, each side in a dispute would have had a different answer to the question whether this principle was really an innovation on the prior art. The theory of inventive combination was refined only towards the end of the nineteenth century, in parallel with the emergence of the modern form of patent claim and rise of manufacture based on standardized parts and tolerances, but even in its less developed form the theory of combination was essential to early patent doctrine. The crucial difference between claims and models was that claims made invention visible only to those with a certain technical competence, whereas models made invention visible to the ordinary juror. Articulated in the form of a working model, a combination became a visual effect, something that could be seen in the periodic operation of a mechanism. And because the elements that entered into combination were supposed to be simple and readily explicable phenomena, their articulation was assumed to be 'comprehensible to a common capacity'.[136]

This mode of second-order invention depended on the fact that a patent model was actually two models in one. In one dimension, the model was a creature of mechanical ingenuity, an artifact embodying a principle that could be identified and explained by expert witnesses in the language of mechanical powers, structures and forces. In its alternate dimension, the model embodied the legal schema of the invention, a 'principle' that was accessible only to the legal imagination. What was the relation between these two principles? Justice Story's admonition that 'the question whether the principles are the same in two machines, is in reality, when all the facts are given, rather a matter of law, than of the opinion of mechanics'[137] noticed only one side of the process of fabrication: the model was a device that allowed lawyers to evaluate the legal significance of mechanical form. In the context of an infringement action 'the opinion of mechanics' necessarily gave way to legal judgment because litigation staged a confrontation between two machines – two models, two patent specifications, two 'inventions' – and the question whether these machines had different principles was one that could only be answered by making distinctions that were legal rather than mechanical.

[136] See reference to Thornton above
[137] ref

But this was where the technique of fabrication came up itself a mode of fabrication. Precisely because inventions were seen as 'combinations' of known mechanical elements, patent lawyers could only make the difference between two machines by forcing increasingly nuanced distinctions from the 'opinion of mechanics', or by scaling mechanical form up into its social contexts. The formal criteria of comparison were so attenuated[138] that the sense of doctrine had to be in the material rhetoric of a demonstration.

The other side of fabrication was less obvious to patent jurisprudence but it is essential to any explanation of how patent models functioned as normative engines. Demonstrations of patent models did not only re-engineer mechanical form, they also re-engineered legal form. The normative content of the doctrinal category of invention was itself actualized – or fabricated – in the encounter with mechanical opinion.[139] Models were not just presentations of machines, they were also presentations of legal texts: patent specifications and precedents or doctrinal writings. The model was both a material hologram of the invention held in the specification and a form in which the doctrinal notion of invention could be made legible to a 'common capacity' in terms of observable differences between machines. Mechanical and legal re-engineering worked reciprocally; demonstrations switched between the two dimensions of the model, engineering mechanical form in such a way as to sustain a favorable interpretation of the doctrinal notion of invention, and engineering legal form so as to ask new questions of mechanical opinion. In one move, the mechanical form became the medium in which the legal schema of the invention was made visible, the semantic potential of legal form being an effect of its expression in mechanical form; in another, this enlivened legal form itself became the medium that 'carried' mechanical form in such a way as to reveal possible interpretations, provoke new questions, refocus attention – in short, to reinvent the mechanical form of the model. In a patent model this process of reciprocal engineering was disguised by the fact that both dimensions appeared as aspects of a single material form, 'matter of law' could be switched almost seamlessly into 'mechanical opinion', legal interpretation into expert evidence. But the point is that the invention was not only represented, but also brought into existence, by this process of commutation. That is the sense in which patent models were jurisprudential engines. Models were not just evidential resources – means of bringing facts into the courtroom – but integral components of the process of legal argumentation; and although this use of material models might now seem exceptional or anachronistic the agency of patent models articulated a kind of normative intelligence that is characteristic of modern law.

[138] Even late in the nineteenth century, when both mechanical knowledge and mechanical jurisprudence had become relatively sophisticated, Robinson could identify only five cardinal variables in the form of a machine: 'shape, size, capacity, proportions, arrangement, or materials'. Book 1, at p 320.

[139] Roy Wagner – convention/invention

In the course of the nineteenth century law 'began to function increasingly like a norm'.[140] The classical forms and institutions of law – which still take center stage in doctrinal accounts of law – were progressively colonized by a specific kind of governmentality.[141] Understood in this sense, norms are characterized by two features: first, they combine cognitive and normative schemata; second, norms are not instruments but ongoing reflexive processes. To begin with, norms construct the world in which they intervene: what legal doctrine takes to be an external dimension of fact is actually an effect of the cognitive or discursive schemata that are held in a norm. Normative knowledge always involves a certain kind of epistemic 'modeling'. Precisely because norms intervene in a world that can be known only through contingent or partial schematizations (the classic example is statistical knowledge) each intervention generates unexpected effects that have to be factored into the knowledge base that informs subsequent interventions. This process of learning is selective: although normative interventions continually generate information that requires refinements and adjustments to the cognitive programs of the norm, only some observed effects will suggest changes in the governmental or normative program. Epistemic modeling is controlled by normative modeling, which in turn calls for further epistemic modeling, and so on. This mode of recollection – selective learning from the past – is complemented by a mode of anticipation. In the process of implementation, normative intelligence anticipates the possible effects of intervention and adjusts the premises of intervention accordingly. And again, this process of extrapolation from the facts has both normative and cognitive dimensions: the anticipation of effects draws on cognitive intelligence (in the form of such things as demographic projections) but what matters is normative value of these projected effects. This generates a kind of normative 'risk': how or to what extent should one intervene in conditions of uncertainty?

The short point is that the normative content of a norm cannot be found in the world – as an existent difference between normal and abnormal events[142] – nor does it exist in the form of a determinate rule that distinguishes *ex ante* between what is permissible and what is impermissible. Rather, both the world and the rule are continually being remade – or fabricated – in the course of operation of a norm. And although this mode of governmental reason is more evident and more evolved in legal or administrative programs that call in systematic ways on statistical, medical, scientific, or economic knowledge, perhaps patent models should be seen as prototypes of this kind of reflexive modeling. Although the question of invention had quite extensive and significant social

[140] Foucault, History of Sexuality, w 1. See François Ewald, L'Etat providence (Paris: Grasset, 1986) and Niklas Luhmann, Law as a Social System (Oxford: Oxford University Press, xxxx), esp. chapter x).
[141] Ref Foucault
[142] For a classic analysis see Canguilhem

ramifications, nineteenth century patent doctrine was hardly a sophisticated kind of governmental discourse. Nonetheless, one can see the process of switching between matter of law and mechanical opinion as a somewhat primitive form of the kind of normative operation that came to characterize modern law.

**Principles**

Our account of patent models as normative engines is obviously speculative. Although it is clear that patent models played a central (and as yet unexplored) role in first instance and appellate patent cases throughout the nineteenth century, the specific way in which they were used to demonstrate machines and texts is a matter of inference and imagination. How can we know how demonstrations mobilized the visible form of a model to distinguish one invention from another? How can we know how, or to what extent, they were used to advance one interpretation of patent doctrine against another? Speculation is unavoidable: even if we were able to go back in time and observe a representative sample of infringement actions we would still be schematizing what we were seeing. Even the most thoroughly immersed ethnography of a practice implies theoretical reconstruction. But there are two reasons for pursuing our account of how models worked. First, although our theory of models as agents of reflexivity seems speculative – theory takes over from historical evidence because we do not have the evidence from which one might glean a sense of how demonstrations were choreographed, and even if we did the theory would control the 'evidence' – the reflexivity that we ascribe to models resonates with what is revealed in many social histories of law. More specifically, this kind of reflexivity can be seen in the jurisprudential figure that replaced the model – the patent claim as a kind of textual machine – so that models can be seen as just one of many vehicles for the kind of normative intelligence that characterizes modern law. It might be objected that this kind of reflexivity generally emerged only later in the nineteenth century, if not later, but our sense is that patent models, precisely because they articulated a novel relation between law and technology, anticipated the emergence of later kinds of discursive 'coupling device'.[143] Second, if what is speculative is the argument that models were something more than items of evidence, and that they were actually crucial to the evolution and reproduction of patent doctrine, then that argument can be corroborated by looking at the premises of doctrine itself. Indeed, the evolution of nineteenth-century patent doctrine is comprehensible only if one notices the sense in which doctrinal argument presupposed what could be seen in the demonstration of a model.

[143] Again, the essential pint is that – the The diffeence, again, is that models ere for jurors, and the question fo how this couolng s worked into th doctrine.

In the nineteenth century mechanical invention was identified with the 'principle' of a machine. The term 'principle' was imported into United States patent jurisprudence by the patent act of 1793, which provided that a patent might be issued to any person 'who shall have discovered an improvement in the principle of any machine', with the reservation that 'simply changing the form or proportions of any machine …shall not be deemed a discovery'.[144] Although the term was new it brought with it a set of difficulties that are quite clearly revealed in English patent jurisprudence, and notably in the celebrated case of *Boulton & Watt* v *Bull* (1795), which was widely discussed in all the leading nineteenth-century patent treatises in the United States. The vocabulary was different: English patent law was still based on the Statute of Monopolies, so formally inventions were patentable only if they qualified as 'new manufactures', and in English law 'manufactures' were to 'principles' as 'invention' is to 'discovery'. So, in *Boulton & Watt* v *Bull* the defendants contested the validity of Watt's renewed patent on the basis that his invention was not a 'manufacture' but a mere 'principle' – not a true invention but a newly-discovered law of nature. What is important here is not the question of discovery and invention itself but a more basic variation on the same theme: how or when could an idea be constituted as property? In the report of the case Watt's separate condenser is variously described as an 'addition', 'improvement', 'principle' or 'variation', precisely because it was difficult to fix the invention in a single and definite embodiment. For one side of the bench this was enough to render the innovation unpatentable: a patent was valid only if it was 'for the vendible matter, and not for the principle',[145] and the statutory reference to manufactures was good because 'it precludes all nice refinements'.[146]

Those judges who found in favor of Watt started from the premise that inventions were intangible things rather than material artifacts – '[s]ome machinery it is true must be employed, but the machinery is not of the essence of the invention but incidental to it'[147] – but they were unable to specify how ideas could be identified and defined other than by reference to the specific shape of their material embodiments. Judges on both sides of the bench invoked Justice Yates' famous dissent in *Millar* v *Taylor* (1769), and in particular the argument that 'property has some certain, distinct and separate possession: the object of it, therefore, must be something visible. I am speaking now, of the

[144] Patent Act 1793, ch 11, 1 Stat. 318-323 (February 21, 1793)). See also section 3 - in section 3 provided that 'in the case of a machine, [the inventor] shall fully explain the principle, and the several modes in which he has contemplated the application of that principle or character, by which it may be distinguished from other inventions'. This amplified the point in section 2 that e notion of a principle also surfaced in section 2, which the patent statute of 1790 made do with cateorizations – the seemed to have banished English law-phantoms by enumerating different kinds of (material) artifact or operation – 'any useful art, manufacture, engine, machine, or device' – as instantiations of the general category of 'the invention or discovery'Some reference to Chakrabarty here?

[145] per heath J 482, 661.

[146] Heath j at 482/661.

[147] 497, ER 668, Eyre LCJ.

object to which all rights are confined. there must be something visible; which has bounds to define it, and some marks to distinguish it'.[148] How could an inventive idea have such attributes? How could one reify an abstract idea in such a way as to delimit a property right? In the United States, the statutory reference to the 'principle' of a machine absorbed into a single word a tension that English law distributed between a plurality of terms. Nevertheless, the leading nineteenth-century patent treatise observed that 'principle' was as good a term as any: 'However inadequate the term may be to express what it is used to convey, it is obvious that there is a characteristic, an essence, or purpose of every invention, which, in our law, has been termed by jurists its principle'.[149] And by the time this observation was made, patent doctrine had, thanks to the agency of the patent model, evolved a fairly precise sense of principles.

**The machine itself**

Commenting on the first major patent infringement case in the United States – *Evans* v *Eaton*[150] – Thomas Jefferson observed that 'it is the invention of the machine itself, which is to give a patent right, and not the application of it to any particular purpose, of which it is susceptible'.[151] What was the machine itself, abstracted from its purposes? Jefferson was pointing towards a notion of invention that got away from the equivocation between material and ideal that characterized the dispute in *Boulton & Watt* v *Bull*. The 'machine itself' was identified not by the tangible or intangible form of a device but by its mode of functioning. According to a definition proposed in 1839, a mechanical invention was patentable so long as what was claimed was 'not a mere function, but a machine of a particular structure, whose modes of operation are pointed out, to accomplish a particular purpose, function, or end'.[152] The essential point of this definition was that a mechanical invention should be identified with the 'mode of operation' of a machine. In other words, the function that defined the 'machine itself' was not the ultimate utility of the device but the specific articulation of its mechanical components. So, whereas English patent doctrine was riven by a tension between what Curtis characterized as the 'literal and figurative senses'[153] of the term

[148] *Millar* v. *Taylor* (1769) 4 Burr. 2303, at 2361-2362, per Yates J. note tha Yates puts inventors ans auhors on the same footing – ref?

[149] At p 10.

[150]

[151] The Writings of Thomas Jefferson, volume 13, p 328, available at: www.constitution.org/tj/jeff13.txt

[152] Blanchard v Sprague 3 F.Cas. 648, 650 (1839). the gloss in Curtis's mid 19th century treatise emphasized that one could not have a patent for the function of a machine as such; a machine patent should encompass 'not a mere function, but a function embodied in some particular mechanism, whose mode of operation and general structure are pointed out' (Curtis papr 93).

[153] George Ticknor Curtis, *A Treatise on the Law of Patents for Useful Inventions*, 1st ed., (Boston: Little & Brown, 1854), at p 58. Atents Refernces the englsis casef of R v Wheeler 2 B & Ald 349, where stated that 'no merely philosophical or abstract

'manufacture', patent doctrine in the United States began to identify mechanical inventions not with some tangible or intangible form but with a visible trace or sensory event: the machine (or model) in operation.

Perhaps, given the 'sensible' quality of mechanical knowledge in the 19th century, it was inevitable that mechanical inventions should have come to be defined in terms of the observable articulations of a machine. But the evolution of this formula was not straightforward. The identification of mechanical inventions with the 'mode of operation' of a machine emerged in response to a particular litigation strategy. Inventors and their assignees soon realized that they could expand the scope of a patent right by shifting the invention from one category of patentable subject matter to another – from 'machines' to 'arts'. A patent that claimed the general process of shaping the form of a hat or molding metal would be considerably broader than a claim to the particular mechanical instrument by which one of these ends was achieved. The first patent statute categorized patentable subject matter as 'any useful art, manufacture, engine, machine, or device, or any improvement therein not before known or used',[154] and this formula remained substantially unchanged throughout the 19th century.[155] The statutory reference to 'art' was taken to mean industrial processes which used chemical compounds or other 'agencies of nature'[156] as means of manufacture – 'the arts of tanning, dyeing, making waterproof cloth, vulcanizing India rubber, smelting ores'.[157] In practice, inventors were more likely to refer to these techniques as 'processes' rather than 'arts', and this semantic displacement was (belatedly) acknowledged in the patent act of 1952.[158] By (re)defining a machine as the means by which an art or process was put into effect inventors could expand the scope of their patent right and charge a broader range of competitors with infringement of their patent. This strategy was made possible by the availability of patent reissues (see below). Inventors were allowed to surrender their original patent for a new patent with a new specification, ostensibly so as to provide a fuller or more accurate description of the invention, but in practice so as to give a foundation for infringement actions against competitors who had invented around the original formulation of the invention.

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principle can answer to the word manufactures'.

154 Patent Act of 1790, Ch. 7, 1 Stat. 109-112 (April 10, 1790), section 1.

155 The statute of 1793 added the category of a 'composition of matter' and compounded the formula 'engine, machine or device' into the simpler category of the 'machine' (Patent Act of 1793, Ch. 11, 1 Stat. 318-323 (February 21, 1793), section 1: 'any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement on any art, machine, manufacture or composition of matter, not known or used before the application.'). and this formula was substantially reproduced in the statute of 1836 'any new and useful art, machine, manufacture, or composition of matter'

156 *Risdon Iron & Locomotive Works* v *Medart* ,158 U.S. 68, at p 77.

157 *Corning* v *Burden*, 56 U.S. 252 (1853), at p 267.

158 See

The doctrinal response to these strategies of expansion was simply to retrench the statutory categories. 'Machines' and 'arts' were defined as mutually exclusive categories: inventors of machines or mechanisms could not expand their patent rights by claiming the machine as the vehicle of an abstract process.[159] The distinction between the two species of invention was authoritatively formulated in the decision of the Supreme Court in *Burr* v *Duryee* (1853):

> A machine is a concrete thing, consisting of parts, or of certain devices and combination of devices. The principle of a machine is properly defined to be 'its mode of operation', or that peculiar combination of devices which distinguish it from other machines. A machine is not a principle or an idea. Because the law requires a patentee to explain the mode of operation of his peculiar machine, which distinguishes it from others, it does not authorize a patent for 'a mode of operation as exhibited in a machine.[160]

Mechanical inventions were to be identified with a mode of operation; or, more precisely, 'a new mode of operation, by means of which a new result is obtained'.[161] And this mode of operation was not to be construed as a trace – or 'exhibition' – of the ultimate utility of the machine; it was to be defined as the simple mechanical functioning of the machine. At the same time, processes were defined in contradistinction to machines, as 'all methods or means which are not effected by mechanism or mechanical combinations'.[162] By drawing such an emphatic distinction between categories of patentable subject matter patent jurisprudence generated a problem that went to the core of the notion of invention and which returned to haunt patent jurisprudence late in the 20th century. The effect of the distinction was to sever means from ends. An inventor could not have a patent for the ends of the machine – its ultimate function – because such a right would be too broad and indefinite: '[The patentee] cannot describe a machine which will perform a certain function, and then claim the function itself, and all other machines that may be invented to perform the same function'.[163] It followed that the invention encompassed by the patent had to be defined not by the

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159 'The term machine includes every mechanical device or combination of mechanical powers and devices to perform some function and produce a certain effect or result. But where the result or effect is produced by chemical action, by the operation or application of some element or power of nature, or of one substance to another, such modes, methods or operations are called processes' (*Corning* v *Burden*, 56 U.S. 252 (1853), at p 267). Reference goes one to observe that 'A new process is usually the result of a discovery; a machine, of invention', a distinction commented below. The point here was to prevent machines from being claimed in terms of their functions: 'cannot describe a machine which will perform a certain function, and then claim the function itself, and all other machines that may be invented to perform the same function.' (at p 269).

160 Burr v Duryee 68 U.S. 531, xxx(1853)

161 Winans v Denmead 56 U.S. 330, 341 (1854).

162 *Corning* v *Burden*, 56 U.S. 252. (1853).

163 *Corning* v *Burden* 56 U.S. 252, 270 (1853).

end but by the means,[164] and the distinction between these two terms had to be drawn clearly enough to allow patents to be issued for alternative means to the same end.[165] So although it was obviously difficult to envision a mechanical invention without having a sense of its ultimate utility, for the purposes of patent law the invention had to be defined and distinguished as a mere instrument; or, to return to Jefferson's formula, the invention lay in the 'machine itself', abstracted from its application to any particular end.

**Means in themselves**

How could one reduce the inventive idea of a machine to a means abstracted from ends? The doctrinal writer who was best qualified to rationalize the philosophical improbability of a 'means in itself' was perhaps William Robinson, who besides being the author of a leading patent treatise and one of the founders of the new Yale Law School, was a theologian who ultimately left Yale to become the Dean of the Law School of the Catholic University of America.[166] Robinson was writing in 1890, at a time when the distinction between machines and processes was being relaxed; for him, the strict mid-century categorization of inventions was just an unfortunate echo of 'the then prevailing ideas in the English courts, that the law could take notice only of the concrete practical invention and not of the abstract ideas which lie behind it'.[167] His rationalization of inventions as mere instruments begins with a restatement of the question: 'What is the essence of an invention? What is the idea whose generation in the mind of the inventor constitutes the mental part of the inventive act? Is it the idea of end, or is it the idea of means, or does it include both?'[168] Although inventive ideas necessarily spanned the means and the end, the job of patent jurisprudence was to abstract the former from the latter: '[T]hough the idea of means cannot be contemplated by the mind apart from the idea of end, the end must be referred to only for the purpose of more fully

[164] The idea that the patted were ot for efecs but only for instrum,emtaltis: see Curtis at p 62: [T]here cannot be a patent for an effect but only for the mode or means by which the effect is produced; or the practical mode of operating, by certain agencies or properties of matter, or laws of physics, so as to produce a given effect'.

[165] Of the four categories of patentable subject matter – machines, processes, manufactures, compositions of matter – the tension was only in the two means – so the idea that rest probmetic but so significant: 'The distinction between a machine and a manufacture cannot be so stated that its application to every case would be clear and satisfactory to every mind. The same remark is true of the distinction between manufactures and compositions of matter. In most instances, however, when something is invented by the mind and constructed by the hand of man, its classification under some one of these heads is sufficiently obvious. If the inventor is certain that his invention belongs to one or another of these three classes of things, but is uncertain as to which, no evil need result from the doubt. No inventor needs to state or to know whether the thing he has produced is a machine, a manufacture, or a composition of matter, provided he knows that it is one or other of these' (Walker, at 15). The reason why it doens;t mate ris precisely because the means and ends is not engage d- the uncertainty might be taxonomic etc, but not so xxx.

[166] See the obituary in Yale Law Jren ournal 1912.

[167] Robonson, book 1, p 120, fn 8.

[168] Robinson book 1, 133.

comprehending the real nature of the means employed'.[169] What remained was an idea of instrumentality, the 'idea of means', which Robinson formalized as the 'intellectual essence of that artificial method by which the inventor has applied to some determinate end, the natural force'.[170] But how exactly was this peculiar kind of conceptual reduction to be performed? How did one isolate the idea of means as the object of a property right?

In distinguishing the two principal means that could be the subject matter of a patent, patent jurisprudence itself proposed the medium in which the distinction should be made:

> [E]verything turns on the force and meaning of the word 'means'. It is very certain that the means need not be a machine or an apparatus. It may be a process. A machine is a thing. A process is an act, or a mode of acting. The one is visible to the eye – an object of perpetual observation. The other is a conception of the mind, seen only in its effects when being executed or performed.[171]

In other words, the difference between machines and processes as two species of patentable means was to be made in terms of their visibility, by imagining two observational perspectives. From one, the machine would appear as a pure mechanical function, or as an animated 'thing'; from the other, it would be apprehended through its immediate effects, as the agent of a 'mode of acting'. Robinson added a further fold to this differentiation of visibilities: depending on how it was observed, a machine could appear in three different guises. Of these the most crucial is that in which the machine appears as a mechanism isolated from its motivating inputs and functional outputs.

First, one could identify a mechanical invention by reference to its 'ultimate end' or 'effect': 'the permanent effect on the material world which remains after the means has ceased to act'.[172] In Robinson's example of a machine for smoothing lumber, the 'ultimate end' of the invention would be observed in the accumulation of the finished product – a stock of planed lumber produced to satisfy a market demand. This apprehension of the invention corresponded to what patent jurisprudence generally called the function of a machine, a broad utility that could not be the proper subject of a patent because such a claim would encompass too many distinct means. Second, the

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169 Robinson, book 1, 137.

170 William C Robinson, *The Law of Patents for Useful Inventions* (1890), at p 199. '[T]he complete result of the inventive act consists in an idea of means, embodied in some instrument or operation, and capable, when brought into contact with its proper object, of performing certain functions and thereby producing in the object certain definite effects' Book 1, at p 214.

171 *Tilghman* v *Proctor* 102 US 707, 728 (1880)

172 Robinson, vol 1, p 315.

invention could be identified as a 'means' which could be observed in 'the actual change wrought by the invention on its object while engaged in the production of its ultimate result'.[173] Elsewhere in the treatise (where, confusingly, this sense of the machine is characterized as 'the function of the means') Robinson suggests that what distinguished this second way of apprehending a machine from the perception of its 'ultimate end' was the fact that what was observed was the immediate effect of the machine, or its effects while in operation. What was in view was the actual operation of the machine rather than the ultimate products of that operation, but the 'action of the means' was observed 'not with reference to the subject acting, but with reference to the object acted upon'.[174] In other words, what was observed was the change in the condition of the material worked by the machine rather than the mechanism of the machine. Here, Robinson was glossing an observation made in the decision of the Supreme Court in *Corning* v *Burden*, where it was observed that the operation of a machine could be apprehended from the perspective of the 'material operated on' rather than 'the [mechanical] method or mode of producing that operation', so that 'we say that a board is undergoing the process of being planed, grain of being ground, iron of being hammered or rolled',[175] and this kind of function could not be patented. In Robinson's terms this apprehension of a machine was still too general to reach the 'idea of means': 'Performed by many different means, it cannot be exclusively attributed to any, but remains open to attainment by all methods which human ingenuity is able to devise'.[176] The idea of the 'means in itself' could be specified only by shifting attention from the material to the actual machinery, or by observing the mechanical articulations of the machine rather than its immediate effects. In the case of a machine for smoothing lumber, one could say that 'the planer [is not] changed in character or capability by the presence or the absence of the lumber; [it acts] with equal energy, and in precisely the same manner, whether [its] action terminates on the material [object], or issues only in the beating of the air'.[177]

So the idea of means (the invention) was elicited by holding the machine in a state of suspended animation: as functioning abstracted from effect. For Robinson, animation was something more than a figure of speech:

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[173] At 317.

[174] P 209. The term function here crops up because intergrates an fglooses the decisionof the Supreme Court in Corning v Burden (1853), which refered to the sense in which 'we say that a board is undergoing the process of being planed, grain of being ground, iron of being hammered, or roled', and observed that thi said nothing abou the 'method or mode of producing that roperation, aso that 'it represents the function of a machine, or the effect produced by it on the material subjected to the action of the machine' (xxx US xxx, xxx).

[175] Corning v Burden at p. xxx.

[176] At p 209.

[177] Robinson xxx, book 1, at p 210.

> [A machine] is an artificial organism, governed by a permanent artificial rule of action, receiving crude mechanical force from the motive power, and multiplying, or transforming, or transmitting it, according to the modes established by that rule. This rule of action, imposed by the inventor on the material substances of which the machine consists, is what the courts have called the 'principle of the machine'; a phrase synonymous with 'modus operandi' and 'structural law'. It is, however, neither more nor less than the idea of means, which is embodied in the machine itself [178]

In other words, machines were animated and individuated by an idea of means in much the same way as living beings were animated and individuated by a vital force or ethological principle; much as a living being existed and functioned even when it was at rest, so too could a machine be said to exist independently of its engagement in any particular instrumental process. Or rather, even when it was engaged in such a process, the machine could be said to have an identity apart from its role as a simple means to an end. It may be that Robinson had in mind the old figure of the automaton – a machine that looked like a living organism because it had an apparently self-sustaining mechanism[179] – but there was a more prosaic doctrinal reason for construing machines as artificial organisms. Patent law identifies the invention with something inherent in the material artifact rather than with the subjective intention or persona of the inventor; so what mattered was that 'rule of action' of the machine should be something active in the very architecture of the machine. The proposition that 'a machine differs from all other mechanical instruments in that its rule of action resides within itself'[180] resuscitated a problematic distinction between 'self-acting' machines and mere tools,[181] but it reconciled the figure of a modus operandi with the most basic premise of patent doctrine.

**The signature of a machine**

To what extent was this theory of machines as means in themselves represented in practical legal argument? Although Robinson's theory of invention was pitched at a higher level of abstraction than routine patent jurisprudence it quite nicely expressed the understanding of invention that informed doctrinal argument in nineteenth-century patent cases. Once again, the mid-century case of *Burr* v

[178] Book 1, 257-258.

[179] One could forget, looking at a mechanical duck or a xxxxxx, that these automata in fact depended on human and intervention to maintain their operation On this theme, see Georges Canguilhem, 'Machine et organisme' in *La connaissance de la vie* (Paris: Vrin, 1992) 101-127.

[180] Notably, it implied the proposition and this in turn created problems via the notion of a self-acting machine, etc – the Book 1, at 259.

[181] Specifically, it created problems with th entuion ohte tool sand oht er instruemtns – the v

*Duryee*, in which legal argument presupposed (and disputed) the definition of invention as the 'rule of action' of a machine, serves as a good example:

> It is obvious that, where the invention is in machinery, the mode of operation embodied in such machinery must constitute the essence of the means of producing the result. If any one think otherwise, let him test it by supposing the mode of operation to be taken away from the machine, and see what will remain. To enforce this truth, imagine, if possible, a machine without any mode of operation, and what is it? Clearly nothing but the wood and metal composing it. This shows that the mode of operation is the characterizing feature.[182]

There are two interesting points about this line of argument. First, it identified invention with a visual effect – with what could be seen in the operation of a machine or a working model. The form of the invention was defined – and delimited – by the periodic articulation of a mechanism rather than by the material or physical composition of the machine. The material form of the machine was simply what remained if one subtracted the vital machine's 'rule of action' from a machine. So, as in Robinson's theory of machines as means in themselves, the invention was defined in terms of what could be observed by isolating the functioning of a mechanism. Second, the patent lawyer's definition of invention as the mode of operation of a machine was every bit as nuanced as Robinson's theory of machines as means; the complex proposition that the invention lay in 'the essence of the means of producing the result' is comprehensible only if one has in mind the process of conceptual reduction that was developed in Robinson's theory of the 'idea of means'. And what is interesting is that the Supreme Court justices to whom the argument was addressed were also expected to have this conceptual premise in mind.

How did reference to the observable performance of a machine (or model) solve the long-standing problem of defining mechanical invention? Ultimately, the question was how to specify embodiment: the intangible invention was supposed to be revealed in the material structure of the machine, but patent doctrine had no clear criteria by which to differentiate ideas from their embodiments or to stipulate how or where the form of the invention could be found in the material form of the embodiment. (Again, we might think of the contingency of the old form-matter distinction). How did patent models help to resolve this problem? How could something observed – a mere sensory impression – have the consistency of a proprietary object? More precisely, how could something observed satisfy the expectation of early modern lawyers that property should be something 'which

[182] Argument of counsel in Burr v Duryee 68 U.S. 531, 554 (1863). This was an argument for th extensiseve interpretation as a way of capturing 'function', but the overall purpose remains – and the

has bounds to define it, and some marks to distinguish it. ...It must be something that is visibly and distinctly enjoyed; that which is capable of all the rights and accidents and qualities incident to property'.[183] The answer lies in the simple fact that the operation of any mechanism is periodic. If, to adapt a classic definition, a mechanism is an assembly of elements that is articulated in such a way that its configuration is maintained (or, rather, periodically restored) throughout the operation of the machine,[184] then this periodicity is capable of definition. The operation of a mechanism is predictable and repeatable, and for the purposes of property law reproducibility is as good as materiality. If an event is reproducible it becomes almost as determinate as a spatial form: it has boundaries, definition and (in the case of a mechanism) structure; it remains identifiable in diverse contexts, and it can be recalled and examined repeatedly. In this form the intangible acquires an almost material consistency. An event can look like an object.[185]

We can develop this point by making a parallel between patent doctrine and copyright doctrine. In copyright the problem of defining literary and artistic works was addressed by treating the work as an expression of the individual style of the author.[186] According to nineteenth-century commentators each creator had a style that was as unique as the human face: 'a literary work really original, like the human face will always have some singularities, some lines, some features, to characterize it, and to fix and establish its identity'.[187] Perhaps, however, the deeper archetype is that of the signature. There is a sense in which a signature is the degree zero of a literary work: signatures trace out the style of their makers, as material traces they embody this personal style, and traces qualify as embodiments because their material or graphical substance is thoroughly 'sculpted' by its maker. Signatures are trained reflexes, so perhaps they lack the kind of spontaneity that is assumed by personality theories of intellectual property; nevertheless, there is a sense in which signatures have to be original. Machine-drawn signatures are insincere because they are not products of a singular and continuous act or event, in which the vital persona of the signatory flows into the trace of the signature.[188] By contrast with a mechanical mark, no iteration of a true signature is identical to another iteration, and this variation reflects the specificity of each act of signing. But although a true signature cannot be machine-made there is a sense in which a (complex) machine can have a signature: the periodic, repeatable, articulation of a mechanism traces out the visual equivalent of a graphic signature. What

[183] *Millar* v. *Taylor* (1769) 4 Burr. 2303, at 2361-2362, per Yates J. note tha Yates puts inventors ans auhors on the same footing – ref?

[184] Canguilhem, 'Machine et organisme', at p 102: 'Un mécanisme, c'est une configuration de solides en mouvement telle que le mouvement n'abolit pas la configuration. Le mécanisme est donc un assemblage de parties déformables avec restauration périodique des mêmes rapports entre parties'.

[185] Spectral materilaity

[186] refs

[187] (Hargrave, An Argument in Defence of Literary Property (1774).

[188] Hence commentary on the paradix that signature rewuires presence but represents absence – Latour and Fraenkel

is expressed is not the style or personality of the inventor but the immanent 'rule of action' of the machine – the complex mechanical articulation that expresses the 'principle' of the machine. Again, this difference matters because patent law scrutinizes artifacts rather than intention or personality. The figure of the machine signature was not an exclusive effect of patent models – skilled readers of texts and drawings could make a working mechanism 'stand out' from the page – but there was nothing imaginary or inferential about the operation of a model.

How was this sensory impression transcribed into doctrine? In the case of a jury trial, which was then the standard forum for infringement actions, it might be supposed that the effects of a demonstration were exhausted once the jury had made its decision. If that were so one could hardly say that models were involved in the fabrication of patent doctrine. It is true that expert evidence and legal argument seemed to give way to the jury's own sense of what models meant: '[The] opinions of [expert] witnesses, in relation to the materiality of apparent differences, are always entitled to great respect. But, after all, the jury must judge for themselves, as well upon the information so given to them, as upon their own view, where the articles, or models of them, are brought into court'.[189] Yet, however important the decision of the jury might have been to the litigants, it was not central to the reproduction of doctrine. To begin with, the demonstration of models were already framed by propositions of doctrine: the mechanical form of a model was mobilized so as to advance a legal argument, and different aspects of that form might or might not be relevant depending on what the argument sought to do. And what mattered in doctrinal terms was not the eventual decision of the jury but the legal directions given to the jury by the trial judge: directions were supposed to give the jury a lesson in patent law tailored to the facts as they were revealed by models and testimony. A direction was addressed by the judge both to jurors and to the appellate tribunals by which it might ultimately be reviewed. And, here, as we have seen, models resurfaced, this time as means of instructing judges as to the 'principle' of a machine. Throughout, familiarity with models functioned as a kind of felicity condition for the effective understanding of arguments about invention. The nineteenth-century doctrinal characterization of the principle as a means in itself was predicated on the experience of observing working models in action, but the reverse was also true: the doctrinal sense of invention shaped the way in which models were demonstrated and observed: what one could see in a model was conditioned by what one might seek to say of it. In this way demonstrations of patent models generated an event that could be observed, analyzed, and written into patent jurisprudence.

[189] Dixon v Moyer

**Form and substance**

How was the notion of invention as a mode of operation realized in infringement actions? How did the operation of a machine (or model) become a matter of dispute, and with what implications? Once again we should begin with the statutory definition of the mechanical invention as the 'principle' of a machine. Infringement actions turned on the question whether one machine resembled another, but resemblance was a matter of 'principle' rather than material form,[190] and because machines were understood as combinations the question of resemblance was really the question whether 'the given effect is produced substantially by the same mode of operation, and the same combination of powers, in both machines'.[191] In infringement actions the question was whether the mode of operation of one machine was truly like that of another, but a 'mode of operation' could be a fake: what looked like a new and distinctive mode of operation might actually be an attempt to disguise infringement. So a further – legal – distinction had to be made between the form and substance of a machine. In earlier patent jurisprudence the difference between form and substance was construed as the difference between material form and conceptual form, or between the 'manufacture' and the 'idea', but given that the figure of the mode of operation evolved precisely because it allowed patent doctrine to resolve this equivocation between tangible and intangible, how was one to distinguish between the form and substance of a mode of operation?

William Robinson had an answer: the 'substance' of a mode of operation was everything in the means that actually contributed to the real-world functions of the machine; anything else was mere 'form': 'Whatever qualities of any art or instrument are indispensable to its discharge of any of the functions for which it was designed by its inventor enter into its essential character, and thus become matters of substance, not form'.[192] To make this difference one had to see the machine as something more than a means in itself; one could no longer reduce the machine to its mere functioning, without regard to 'whether [its] action terminates on the material [object], or issues only in the beating of the air'.[193] Instead, one had to look from means to ends:

> [T]he means devised by the inventor can be a means only so far as it accomplishes effects, and can exist in his mind only so far as it performs the function he intends it to discharge, [so] the

[190] [T]he principles of two machines may be the same, although the form or proportions may be different. They may employ substantially the same power in the same way, though the external mechanism be apparently different. On the other hand, the principles of two machines may be very different, although their external structure may have great similarity in many respects Barrett v Hall at p 923.

[191] Odiorne v Winkley

[192] Loc cit.

[193] Robinson xxx, book 1, at p 210.

limits of the means become at once apparent through their correspondence with the functions thus discerned.[194]

Where did this leave the theory of the invention as the idea of means? Were machines not now being defined in terms of their functions, which was precisely what doctrine proscribed? According to Robinson, reference was made to functions only so as to clarify the essence of the means: 'though the idea of means cannot be contemplated by the mind apart from the idea of end, the end must be referred to only for the purpose of more fully comprehending the real nature of the means employed'.[195]

Again, however abstractly the point was made, Robinson was expressing an entirely conventional sense of the relation between means and ends, one that informed and continues to inform patent doctrine. Machines were instruments; they were engineered to perform certain functions, and although these functions would have guided the design of a machine's structure and components, once the structure was built it acquired an independent, tangible, existence. A machine was a 'solidified theorem',[196] an idea made real in the structure and articulation of a mechanism. Whereas functional accounts of machines black-box the structure and articulation of their mechanisms, noticing only their inputs and outputs, the definition of the machine as a means in itself focused attention on what happened inside the black box, within the brackets defined by these inputs and outputs. For Robinson what happened within the black box was analytically distinguishable from what happened outside the brackets: the mechanism of the machine remained self-contained, bounded and representable as such. The point of referring to functions was only to distinguish those parts or movements which were essential from those which were bolted on to disguise infringement.

However conventional it might be, this division of means from ends is implausible. To begin with, the idea that one can distinguish essential and inessential parts or movements assumes that machines have determinate and self-evident functions. The reality, however, is that functions are not inherent or natural properties of machines; they are ascribed to machines by users and observers who have in mind some proper mode of functioning. In other words, functions correspond to normative expectations. And this normative sense of function informs the description of structure. The identification or individuation of physical 'parts' or 'sub-parts' within the 'whole' structure of a mechanism presupposes an idea of what the machine is for and how its various components co-

[194] Patents, bok 1, at p 318.
[195] (Robinson, book 1, 137).
[196] Ref Canguilhem

operate to effect that function.[197] The anatomy of a machine varies according to one's sense of its function. Contrary to what Robinson assumed, the relation between structure and function is not static but dynamic. In practice structural and functional descriptions are not easily distinguishable, and are typically the poles of an oscillating relation in which 'physical properties are explained in terms of functions and functions in terms of physical properties'.[198] This returns us to the theme of fabrication, or second-order invention. All machines have a multiplicity of potential identities, each of which emerges at one possible point of intersection between structural and functional description. The signature of the machine – its mode of operation – traces out such an intersection, and opposing demonstrations of a model would reveal different modes of operation, alternative signatures, different accounts of what was essential or inessential to the functioning of a mechanism.

This prompts a question: how can this process of second-order invention be reconciled with the doctrinal sense of property? How could a contingent form have the definiteness that was sought by early nineteenth century lawyers? How could the signature of a machine be at once authentic and negotiable? Everything depends on how one understands 'property'. First, the legal form of property consists in a normative aspiration rather than a real world effect. Property is not a thing but a discursive artifact, and depending on the context in which it takes shape this artifact is realized in different ways and to different effect. Second, the legal form of property is just one of many 'representations' that enter into relation to constitute what Bruno Latour calls a 'matter of concern': an object that 'brings people together because it divides them'.[199] What legal doctrine sees as a determinate thing – the object bound by property rights – is in fact a multiple entity, an object that is constituted and animated by the tension between the engagements of diverse actors. In these terms the legal form of property does not directly bind things in the world; it merely participates in the constitution of a matter of concern. Latour derives this notion of objects as 'matters of concern' from one of the oldest legal definitions of property. In Roman law an object of property – a *res* – was not a substantial thing or object but a *res de qua agitur*, or the 'matter in question' in a legal dispute: 'To the extent that the *res* was an object, it was first and foremost the object of a debate or a controversy, and thus a common object that at once opposed and united two protagonists in a single relation'.[200] The thing in question could be anything: material or immaterial, thing or person. Its proprietary qualities were ascribed to it by law rather than found 'in nature', and the definition of these qualities, or of the legal quiddity of the thing, were precisely what was disputed (and settled) in litigation. So 'property', in the

[197] ref needed

[198] See Peter Kroes, 'Coherence of structural and functional descriptions of technical artefacts' (2006) 37:1 Studies in History and Philosophy of Science 137-151, at p 143.

[199] Bruno Latour, 'In Making Things Public, at p 13.

[200] Yan Thomas, 'Res, chose et patrimoine', (1980) 24 *Archives de Philosophie du Droit*)

sense of a specific entitlement, is thoroughly fabricated by legal discourse. Archaic Roman law was more at home with this notion of fabrication than is modern law: for modern lawyers what is in dispute in a case about property is only to whom something belongs, or the extent of the owner's rights; law does not actually construct the thing to which these rights are ascribed. But the way in which patent models fabricated invention by switching between mechanical opinion and matter of law is an almost perfect illustration of how both rights and things are fabricated in the course of litigation.

The 'mode of operation' of a machine was simply the name for the 'matter in question' in infringement actions: it was the conventionalized form that property had to take when it was defined. And beyond the obvious sense in which the two sides in an action disagreed as to what the mode of operation of a machine was, the process of actualizing property involved a quite radical process of discursive fabrication. Like other figures of property, the signature of a machine was a virtual form that was made actual in the course of argument, and argument was informed by a perception of the broader social implications of defining invention in one way rather than another.[201] One should not overstate the social imagination of nineteenth century patent doctrine, but judges and lawyers obviously saw themselves as having a leading role in forging a socially effective patent system.[202] Perhaps the relation between the two figures of the *res de qua agitur* and the 'matter of concern' is simply the relation between law and society. More precisely, it is the relation between 'property' as it is construed in litigation and the complex social events to which property is ascribed. In these terms, patent models were an almost perfect realization of the object of property as a *res de qua agitur* – a legal form whose attributes and effects were settled by dispute; they illustrate the process of fabricating rights and things so well because the virtual form of the 'matter in question' was actually a material thing.

**Textualization**

In 1807 the Newengland Association of Inventors and Patrons of the Useful Arts, which for a brief period published a journal called *The Useful Cabinet*, recommended to its members that they should have a model of any new invention locked away in a secure cabinet as a proof of the date that it was made.[203] The model was the most immediate evidence of invention; it spoke for itself, and the sealing of the cabinet dated the invention more effectively than any written record. A similar sense of models as authentic embodiments informed the patent act of 1836, which restored the requirement

201.

202 See Prager on Story and Morriss & Nard (2008) on constituencies.

203 Steven Lubar, 'The Transformation of Antebellum Patent Law' (1991) 32:4 *Technology and Culture* 932-959, at 937.

to submit models in part because (unlike a text) a model did not have to be construed or interpreted.[204] A more cynical view of the evidential value of models emerged towards the end of the nineteenth century. In 1879, commenting on the practice of granting amended or reissued patents, the *New York Times* made a sharp distinction between texts and models:

> The patent is granted for the invention described in the papers filed in the Patent Office. The model forms no part of the patent, or the application, and is not published to the world. Its object is simply to illustrate or 'exhibit advantageously' what is claimed in the application. The serious objection which has been brought against its use in granting reissues is that it may easily be made to show features and principles not embodied in the original invention, or indicated in the original invention.[205]

Far from being the most complete, authentic, and incorruptible token of invention, the patent model was now seen as being too expressive, too malleable, and too susceptible of interpretation. More precisely, the practice of returning to the patent office model as a proof of invention compromised the certainty of drawings and written descriptions. The patent specification was now a singularly complete and definite embodiment of the invention.

The contrast between these two characterizations of the patent model indexed a significant and complex historical transformation, which was expressed in a change in the archive-function of the Patent Office: 'With new technologies of reproduction, the Patent Office changed form a typical (pre-modern) archive – a centralized depository, closely guarded physically and socially – to an archive without a center, an archive-system, one among many of the dispersed systems of modernity'.[206] At the start of the nineteenth century, within the localized settings and limited channels of communication that constituted the world of invention, the patent model was the only truly public representation of the invention. The patent specification – which was retained (and to begin with jealously conserved) by the patent office – remained private, inaccessible, and intrinsically opaque.[207] With the advent of lithography and the broad circulation of patent specifications in the *Scientific American* and the *Official Gazette* the terms of this contrast were entirely reversed. In the newly-expanded public sphere of invention the patent specification and drawings became the only truly open representation of the invention, and models, which were retained within the Patent Office,

[204] See Kendall J Dood, Part I, at 211-214.
[205] The patent bill, *New York Times*, January 11 1879.
[206] William Rankin, 'Bureaucracy at a glance: visual evidence and US patents, 1790-2005' in Biagioli, Jaszi & Woodmansee (eds) *Contexts of Invention* (Chicago: University of Chicago Press, 2009) xxx-xxx, at p xxx.
[207] Thornton and the problem of access to texts

shrank into relative obscurity. As Mario Biagioli observes, the nineteenth century was the period in which the inventive idea 'moved into the halls of soon-to-be-established patent offices to become the primary focus of patent practice, while its material embodiments stayed outside, in the world of manufacture and commerce'.[208] Textualization allowed the invention to circulate independently of its embodiments. And the medium shaped the message: the fact that text was the medium in which inventions could effectively be communicated across distances meant that the legal category of invention began to take a form that could be communicated in this medium. In parallel with the evolution of new kinds of textual technology – principally, conventions of written description and drawing – patent jurisprudence evolved a prescriptive theory of how patent texts should be read: the invention could be fixed in text and constituted as property only by controlling the meanings that readers could elicit from the text. In the guise of the 'person having ordinary skill in the art' patent jurisprudence developed a fictional reader that was very different from any actual reader of patent texts,[209] the difference between the fictional and the actual being simply the difference between a legal norm and the domain to which it was applied.

Given that models were still quite routinely used as means of communicating invention, what place could they have in the new regime of text? How could the expressivity of a model be flattened into the surface of a text? For a good part of the nineteenth century patent jurisprudence had exploited the hermeneutic richness of models. As normative engines, models brought texts alive; they made vivid the invention described in the specification, they actualized the legal category of invention, and they staged the reciprocal translation of mechanical knowledge into legal form. But even if the model often eclipsed the text, the procedural premise was that the text preceded the model, and that the demonstration of the model was informed by the contents of the patent text. As, progressively, the invention was condensed into textual form it was relatively easy for patent jurisprudence to 'return' to the text in which the invention was supposed to be already embodied.[210] Things were different in the context of patent examination. Although a survey of the ways in which models were used within the examination process is beyond the scope of our study, there was an obvious difference between patent adjudication and patent examination. Whereas adjudication was concerned with the interpretive 'reflation' of texts – often, admittedly, with the assistance of extrinsic evidence such as witness testimony or a scale model – examination was concerned with the initial fabrication

[208] Mario Biagioli, 'Patent Republic: Representing Inventions, Constructing Rights and Authors' (2006) 73:4 *Social Research* 1129-1172, at p 1144.

[209] And importantly different from the conventions – the theory was not one of how texts were actually rea d- it was a that held steady s fiction that controlled how actually read – th enorm in the xx 9see Rankin again).

[210] Storrow on models

of texts from raw materials.[211] In the domain of adjudication events were seen or recapitulated only through the screen of text; the chains of reference that relayed texts to events could be reconstructed, but events were already qualified by their textual representation. In the context of examination, by contrast, the object was to translate the raw ingredients of invention – the impressions made by interviews or discussions centered on models, drawings or drafts of texts – into a finished text. Examiners would have been more or less susceptible to extra-textual forces, depending on the volume of applications; it may be that examiners in the mid nineteenth century were simply too overworked to do much more than rubber-stamp applications in due form.[212] But the difference between reflation and fabrication surfaced in a particular context, namely, the adjudication of patent reissues.

From 1832 onwards the patent statute allowed inventors to return to the Patent Office to seek an amendment and reissue of an issued patent, which meant in effect that the patentee could seek to have the original patent rewritten to meet failings that had been exposed since the date of issue. Most of the appellate patent cases of the period are cases in which the courts found themselves deciding an infringement action based on a reissued patent. The question of patent reissues is rarely addressed in legal-historical scholarship, but it can be seen as one of the principal factors in the evolution of the modern form of patent claim and specification. And although models could hardly have survived the mobilization of texts as media of communication, the difficulties generated by the reissue procedure also played a large part in determining how models were ultimately displaced by texts. The question of reissues brought patent models sharply into focus as obstacles to the perfection of text and as means by which inventors could evade terms fixed in text. We should notice immediately that the kind of model that was exposed to scrutiny in this way was not the litigation model but the Patent Office model. Within the context of adjudication models were still used to illustrate the invention, the understanding being that the terms of the text controlled the meaning of the model.[213] The trouble with reissue procedure was that it obliged the courts to take an interest in how models were interpreted in the Patent Office: in order to regulate the grant of reissues patent jurisprudence had to bring the Office model within the purview of adjudication. This forced a confrontation between the processes of examination and adjudication and added urgency to the question of how to settle the relationship between the courts and Patent Office. The division of labor would have had to be negotiated sooner or later, but the question was now inflected by the specific complexities of reissue procedure. Crudely, had the process of examination been entirely concluded by the time any

[211] Of course,. Now onemight say that the whole thing is textual – th eprioir art is textual, and the texts accommodated to horizon of texts - the

[212] Refs?

[213] When did models stop being used in court – e.g. what is the last Supreme Court case?

given patent reached the courts, the process of reducing inventions to text might have proceeded quite smoothly; but so long as a patent could be rewritten and reissued, perhaps in response to an unfavorable court decision and perhaps more than once, the order of texts was constantly being unraveled.

The Office model symptomatized this tension particularly acutely because it represented what had to be sacrificed if inventions were to be effectively embodied in text, namely, the ideal of immediate and authentic representation that was imagined by the curators of the *Useful Cabinet*. Textual representations are selective, partial, conventional and formalized, and historically the reduction of property to paper has always generated tensions between form and substance. In the case of patent law, the Office model became the hinge between a set of related tensions: two senses of the reality of invention, two kinds of institutional procedure, and two theories of representation. The last episode in our story of how models informed patent jurisprudence is one in which the Office model – located offstage, one might say – occasioned the development of a doctrinal theory of meaning and intention that turned texts into complete embodiments of invention. In the process of regulating how the Patent Office used models as evidential resources in reissue proceedings, patent jurisprudence evolved a theory of the 'original invention' that turned text into the medium by which inventions were communicated between the Patent Office and the courts and circulated within the new public sphere of invention.

**Names and things**

In 1813, William Thornton adopted the practice of reissuing 'corrected' patents to inventors who could convince him that the original patent text inaccurately described their invention.[214] Patent Office practice was approved in 1832 by the decision of the Supreme Court in *Grant* v *Raymond*,[215] which was ratified by a patent act of the same year.[216] The decision in *Grant* justified reissues by characterizing patents as contracts made between inventors and the public; if there were no corrective mechanism for ensuring that the terms of the patent recorded a fair bargain between inventor and public, the function of patent rights as incentives to disclose invention would be compromised, and the public would acquire a benefit for which it had not given full consideration:

[214] See Kendall J Dood, Pursuing the essence of invention' at 1001, and also Willis B. Rice & William L Grossman, 'Reissued patents and intervening rights' (1933-34) 43 *Yale Law Journal* 766-793, at 770.
[215] Grant v Raymond 31 US 218 (1832).
[216] See generally Kendall J. Dood, 'Pursuing the essence of inventions: reissuing patents in the 19th century' (1991) 32:4 *Technology and Culture* 999-1017.

'If, by an innocent mistake, the instrument introduced to secure this privilege fails in its object, the public ought not to avail itself of this mistake, and to appropriate the discovery without paying the stipulated consideration'.[217] The patent act of 1832 gave legislative form to this jurisprudential rationale. It provided that whenever a patent was 'invalid or inoperative' because it failed to comply with the description and disclosure requirements stipulated by the patent statute of 1793[218] the Secretary of State had the authority to accept a surrender of the old patent and grant a new patent to the patentee for his invention.[219] The essential condition was that the new patent should be for the same invention as that which was (ineffectively) described in the original patent, and that the patentee's failure to comply with the disclosure requirements should have been 'by inadvertence, accident, or mistake, and without any fraudulent or deceptive intention'.[220]

Although it is now largely forgotten,[221] the practice of reissuing patents was probably the most significant factor in the evolution of patent law in the latter part of the nineteenth century. To begin with, most infringement actions were premised on reissued patents, [222] and the Supreme Court decisions that formed the core of patent jurisprudence were almost all made in cases concerning reissues. All of the central decisions in which the distinction between processes and machines was elaborated were concerned with reissued patents[223] because inventors or their assignees exploited reissue procedure to shift their invention from one statutory category to another, typically from 'machines' to 'arts'.[224] So the definition of mechanical invention was framed by the law relating to reissues, and many of the inflections of mid nineteenth century doctrine make sense only if they are seen in the context of the expanding use of reissues. Decisions that were ostensibly about the definition of the statutory categories of patentable subject matter might now be seen as attempts to control the use of reissues, and about defining the respective roles of the courts and the patent office in defining invention. In any case, as the century unfolded the debate about reissued patents became increasingly central to patent doctrine. In the first edition of Curtis's treatise of 1857, the presentation of reissue jurisprudence took up only ten pages; in Robinson's treatise of 1890 the topic

[217] Grant v Raymond at 244. The court had a straightforward answer to objection that there was no statutory authority for the practice of reissue, in which the Secretary of State (as nominal head of the Patent Office) seemed to be acting judicially rather than ministerially: 'If the mistake should be committed in the department of state, no one would say that it ought not to be corrected. Why should not the same step be taken for the same purpose, if the mistake has been innocently committed by the inventor himself?' (at 242).

[218] Which provided (in section 3) that an inventor should 'deliver a written description of his invention and of the manner of using, or process of compounding the same, in such full, clear, and exact terms, as to distinguish the same from all other things before known, and to enable any person skilled in the art or science of which it is a branch, or with which it is most nearly connected, to make, compound, and use the same'.

[219] Act of 1832. 4 Stat. 559, section 3.

[220] Section 3.

[221] Ref to modern reissue practice.

[222] Statistsics on the numbers of reisues?

[223] See notably Le Roy v Tatham 55 US 156 (1852),

[224] One patentee admitted that the scope – because it

occupied 160 pages, forming by far the most substantial chapter of the work. For the purposes of this chapter, the complexities of reissue jurisprudence are interesting mainly because they shaped the concluding phase of the history of patent models.

The core problem for patent jurisprudence was that a reissued patent effectively took the place of the original patent: it gave the patentee or assignee priority from the date of the original grant and was valid for the residue of the original patent term.[225] Although no damages could be claimed in respect of infringements that occurred before the date of the reissue, the new grant operated retroactively to allow the patentee to seek an injunction preventing competitors from continuing production processes that had begun before the grant of the reissue, before these manufactures had been qualified as infringements. The problems to which this might give rise were obvious when reissue practice was first formalized,[226] and the subsequent expansion of the statutory basis for reissues did nothing to alleviate anxieties. The patent act of 1836 provided that a patentee would be entitled to a reissue not only where the original patent was 'inoperative or invalid, by reason of a defective or insufficient specification', but also where the specification was erroneous 'by reason of the patentee claiming as his invention more than he had a right to claim as new'.[227] This provision was interpreted broadly to allow reissues not only to reduce the scope of an excessive claim but also to broaden the scope of inadequate claims. Although the statute seemed to have overlooked the possibility of an overly narrow claim – 'it was probably supposed that the patentee would never err in claiming too little'[228] – the principle that a patent text should reflect the actual invention was taken to justify treating expansive reissues on the same footing as limiting reissues.

When the practice of reissuing patents first emerged it expressed the prevailing idea that a patent was just the formal recognition of a natural fact. For example, in one of the many decisions concerning

[225] In Grant the theory was that 'the new patent, and the proceedings on which it issues, have relation to the original transaction. The time of the privilege still runs from the date of the original patent'.At 244.

[226] In *Grant* v *Raymond* the patentee sought a reissue expressly so as to take action against a competitor who had established a factory producing artifacts which did not infringe the original patent. Arguing that competitors were entitled to rely on the terms of the original patent specification, the defendant's argued that the effects of reissue practice would be 'monstrous': 'Patentees would try their claims under one specification; they might fail; and they would call it inadvertence and try another experiment'. (argument of counsel, Hence the comliant made by counsel for the held to have infringed the reissued patent, who went on to argue that: 'The defendants erected their works in 1823, 1824. They knew of the plaintiff's patent of August 11, 1821, but it did not describe any machinery used by them. But in 1825 he surrendered his first patent, took out another, with a specification describing their machinery, and sued them. Under the direction of the court he has recovered a verdict of three thousand two hundred and sixty-six dollars; and is entitled of course to have this trebled and the defendants ruined. Is this legal? (*Grant* v *Raymond* 31 U.S. 218, 230 (1832)).

[227] Some sigbificvance to word specification. The 1836 sttute mattered because the intriductionof the first modern claiming requirement – the added ot e 1793 requirementthe stipulation that the inventor should 'particularly specify and point out the part, improvement, or combination which he claims as his own invention or discovery' (section 6). Held that the xing on the use of the word specify, Robinson argues that the specification meant claim rather than description. So when the

[228] Miller v Brass Co (1881), at xx0

Evans' automated mill it was said that an inventor acquired an 'inchoate' property right[229] at the moment of invention.[230] The original act of invention merely awaited its ratification by means of a legal instrument. To some extent, this theory of invention was advanced as an attempt to differentiate the emerging patent regime of the United States from the English regime of patents as privileges, and it was accompanied by the idea that patents should be construed 'liberally' so as to give inventors their natural due.[231] But the essential point was that patent rights should be premised on substance rather than form. In 1857 a commentary in the *Scientific American* welcomed a decision by the new Commissioner of Patents, Joseph Holt, on the basis that it promised to curtail a trend towards formalism in Patent Office practice. It was important, observed the editors, to recognize that 'names are not things'.[232] In the course of patent examination, it should be 'sufficient if the specification describes an invention uniting the indispensable requirements of novelty and utility, [and] the applicant [should] not be embarrassed or impeded by the demands of the Examiners in reference to terms and words'.[233] Ironically, perhaps, the other side of the argument was represented in a commentary that appeared in the same journal just two years later, which set out the basic objection to reissued patents:

> It has become quite common for the holders of valuable patents when infringed, to obtain a re-issue, before a suit is brought, with claims so worded as squarely to meet the infringer. In other cases where parties are using an invention without infringing, because not then covered by the claim of the patent, it is a practice to have the grant re-issued, with a claim that will render any further use an infringement.[234]

[229] In another of the cases involving Oliver Evans, Justice Marshall proposed that patent was inchoate and only 'perfected' by the issuance of a patent: 'the Constitution and law, taken together, give to the inventor, from the moment of invention, an inchoate property therein, which is completed by suing out a patent' (Evans v Jordan 8 F.Cas. 872, 873 (1813)).

[230] See Evans v Hettich, ; see also the letter by Jefferson

[231] See for example *Blanchard* v *Sprague* 3 F.Cas. 648, 650 (1839): '[Patents] are clearly entitled to a liberal construction, since they are not granted as restrictions upon the rights of the community, but granted to promote science and useful arts'; *Wyeth* v *Stone* 30 F.Cas. 723, 728 (1840); Most of these are by Story – see xxxx.

[232] Scientific American

[233] Scientific American (1857) 13:10, 77.

[234] 'Reissues' SA 14, April 16 1859, at p 262.. The journal had in mind scenarios such as that which was revealed in the case of *Burr* v *Duryee*, which we have already encountered in the guise of a decision on the difference between machines and processes. The case was characterized as the most important patent case of the century by the *New York Times* not because it retrenched the distinction between machine patents and process patents but because it proposed a restrictive approach to reissue practiceThe case involved a patent for an improvement in the art of hat manufacture. The plaintiff was the assignee of a patent granted in 1846 as a patent for a machine rather than a process. The basic technique of using convection to mould hat bodies automatically had been invented in 1833. The original patent claimed that the improved part 'may be operated by hand instead of machinery, thus substituting the attention, skill, and cost of an operative for the positive regularity and cheapness of mechanical movements (see *Burr* v *Duryee* 68 U.S. 531, 547). Perhaps this was an equivocation The 1846 patent equivocated between machine and process by stipulating that the improved technique could be implemented either by machine or by manual labor. described a 'new and useful improvement in the machine for making hat-bodies', namely the use of a hinged tunnel to regulate the deposit of fibers in such a way as to form the desired shape of hat, and. Having taken up an invitation to visit the defendant's factory to witness the operation of a patented improvement to his machine, he promptly obtained a second reissue of the 1846 patent having already sought one 1n 1856) expanding the claim for a machine into a claim for a process. On the basis of the new patent he sued the defendants for

The essential complaint was that returns to an 'original' invention were almost always opportunistic attempts to claim the future of an invention.[235] This was precisely why in its final decision in the case of *Evans* v *Eaton*, the Supreme Court argued that patentees should be held to definite claims, otherwise the patent specification would become a text with 'a sort of elastic ambiguity, capable of contraction, if not of expansion, so as to adapt itself to whatever it may be found convenient at any time to embrace'.[236] Property could be defined only by insisting on the formalization of names.

**Vindication**

The tension between names and things can be seen as an effect of the embodiment and communication of inventions in text. Again, the point is that medium conditioned the message: more precisely, the medium conditioned the propositional content of the message, or the way in which it referred to things in the world. The meaning or validity of any representation or definition of invention was determined not in terms of an axis of reference or correspondence – how closely does the 'name' correspond to the 'thing' that it names? – but in terms of an axis of communication: what meaning has the name come to acquire in the course of communicative exchange, in the

infringement. The reissued patent claimed the 'mode of operation' of the machine, but the specification qualified the claims by describing the invention as including 'other' modes 'having the same mode of operation, or principle, and only differing from it in form, or in the substitution of equivalent means' (at 158). The Supreme Court held that this was an abuse of the right to seek a reissue: 'This privilege was not given to the patentee or his assignee in order that the patent may be rendered more elastic or expansive, and therefore more "available" for the suppression of all other inventions' (at 577). A witness giving evidence to te 1877 congressional committee on patents saw the facts of Burr v Duryee as exemplary of a common practice: '[Along] comes one of these patent sharks or patent speculators. He goes down to the office and rakes [a class of patents] over with a fine-tooth comb to see if he cannot find an old patent which cannot be reissued to cover [a] successful machine [invented by another]. He comes across [an] old defunct patent and goes anf buys it. The owner, of course, is glad to get what he spent on it, and may take a hundred dollars for it. Very frequently the man is dead, and he will go to the widow or heirs, and they will take anything he offers them for it. He reissues that patent. [He] has the specifications and claims prepared with special reference to covering this successful machine, and when he gets his patent he goes to the manufacturer and says "You are infringing my patent". The manufacturer examines the matter, and it seems to be a clear case' (at p 79). In Burr v Duryee the theory that patents should record the natural form of the invention, and that an inventor should be allowed to seek as many reissues as were necessary to reach a true correspondence between the name and thing, survived into the latter part of the century. Indeed, no sooner had the Supreme Court rendered its decision in *Burr* v *Duryee* than the owner of the patent sought yet another reissue in which the invention was finally categorized as a combination, and which claimed the overall combination and its parts. When this reissue was contested in an infringement action, the court held that the invention had finally been given its proper name: 'the amendments of the specification and claims, and the reissue of the patent since [the decision of the Supreme Court], have more completely exhibited the extent of [the] invention, and have placed some of his separable patentable combinations in such a position as to enable the courts to grant the owner of the patent that protection which they were unable to do under his original defective specifications and claims' *Wells* v *Jacques* 1 Ban. & A. 60, 29 F.Cas. 658, 664 (1874).

235 'New light breaking in upon the patentee as the progress of improvement goes on, and as other inventors enter the field, and his monopoly becomes less and less necessary to the public, might easily generate in his mind an idea that his invention was really more broad and comprehensive than had been set forth in the specification of his patent. It is easy to see how such new light would naturally be reflected in a re-issue of the patent, and how unjust it might be to third parties who had kept pace with the march of improvement' (*Manufacturing Co* v *Ladd* 102 U.S. 408, 413-414 (1880).

236 20 U.S. 356, 394 (1822).

dynamic relation of utterance to understanding?[237] In patent jurisprudence, this performative effect of language was recognized in normative terms: the semantic value of the name was defined in terms of what the sender (the inventor) had given his addressees (the public) to understand. The notion of intention was at the center of this normative formula; the basic principle of reissue jurisprudence was that a reissued patent should be confined to the scope of the original invention, which was defined as the invention that the patentee originally 'intended' to patent. The purpose of a reissue was only to allow the inventor to give 'a more perfect description of the invention intended to be claimed by him in the [original patent]'.[238] The shift towards texts as the primary embodiments of invention was represented in a sharp change in the meaning of intention. At the outset, the originally intended invention was the invention that was pointed out by the text of the original patent. The invention existed as an actuality – a thing rather than a name – and even if the inventor had failed in his attempt to represent the thing in effective legal terms, a patent examiner could follow the indicative line of intention toward the thing and realize the inventor's intention by means of a properly formulated reissue. By the end of the nineteenth century this understanding had been displaced by the idea that the intention of the original patent was the intention that it effectively communicated to the broader public of mechanics and manufacturers. Even if the invention existed as an actuality the scope of the reissue would be limited to the terms in which the inventor was deemed to have communicated the invention to the public.[239] In theory, the name still referred to a thing, but it did so only selectively.

Patent doctrine came to hold the inventor – as the 'author' of the patent text – responsible for this selection. According to the justification proposed by the Supreme Court in *Grant* v *Raymond*, the proper function of reissues was to correct mistakes. Because inventions could not at that time be demonstrated or otherwise disclosed to the public without loss of priority[240] specifications were probably drafted and filed quite hurriedly, and in the absence of an examination procedure there was no occasion to renegotiate and adjust the terms of the specification once the application had been filed.[241] Moreover, patent specifications were seen as specialized instruments, which most inventors

[237] For discussion s this logic see habermasa dn Luhmann refs

[238] Knight v Baltimore Railroad Co (1840) 3 Fisher 1, 3.

[239] Perhaps the reference to intention was so readily taken up by patent jurisprudence precisely because it contained the tension between names and things; in any case, the idea that intention was an effect of communication rather than a subjective state of mind resolved that tension by offering a plausible justification for beginning with names rather than things. The old ide was that essential ambiguity of intention, which could be construed either as attempt or effect, reproduced the tension between names and things. From one perspective, the originally intended invention was the invention that was pointed out by the text of the original patent. The invention existed as an actuality – a thing rather than a name. Even if the inventor had failed in his attempt to represent this actuality in adequate legal terms, a patent examiner could follow the indicative line of intention toward this existent thing, and then fulfill the inventor's intention by specifying the invention in a properly formulated reissue. The alternative interpretation, which gathered force towards

[240] Ref the 1839 act.

[241] Note Thornton's informal caveat procedure.

were not qualified to draft or review for themselves.[242] The basic premise was that most inventors were ignorant of law, and that the patent office should be ready to assist them in translating mechanical knowledge into legal form. Two decades later, things looked very different. In *Burr* v *Duryee*, in 1856, the Supreme Court acknowledged that there had been a time when '[f]ew inventors, or even learned lawyers, were capable of correctly and clearly setting forth in a specification the proper limits of the just claim of the invention', the court argued that since 1836 patent administration had evolved to the point where 'not only the Patent Office but the bar can furnish gentlemen fully competent to the task of drawing up proper specifications, and but little liable to commit blunders from inadvertency'.[243] Inventors were now responsible for ensuring that their patent specifications properly reflected the invention that they intended to claim. Although the older view of legal naivety lingered on,[244] patent jurisprudence in the second half of the 19th century constituted patents as technical legal instruments by externalizing the question of legal competence. The inventor or patentee was presumed to be a person doubly skilled in the mechanical and legal arts, a person to whom any deficiency in the translation of mechanical operation into legal effect in the patent text would be immediately apparent. If an inventor complained of mistake, then in most cases one could say that, 'an inspection of the patent, when issued, and an examination of its terms, made with that reasonable degree of care which is habitual to and expected of men in the management of their own interests, in the ordinary affairs of life, would have immediately informed him that the patent had failed fully to cover the area of his invention'.[245]

This presumption radically changed what was meant by the invention 'intended' to be secured by the original patent. The early justification of reissues assumed that intention that defined or qualified the patentable subject matter was the subjective intent of the inventor rather the communicative effect of the patent text. In *Grant* v *Raymond* the Supreme Court invoked a rather curious argument to support the proposition that the public would rarely be misled by an inoperative specification: 'It is not

[242] 'A specification requires to be drawn with great accuracy. Mechanics, by whom machines are usually invented, it cannot be supposed are capable of drawing a proper specification. Can it be supposed that the law ever intended to punish their ignorance in drawing a very special legal paper by a forfeiture of all the advantages of their invention?' (argument of counsel, *Grant* v *Raymond* 31 US 218, 236 (1832)).

[243] At 575.

[244] See for example *Blake* v *Stafford* 6 Blatchf. 195, 198 (1868)): 'Inventors are not usually sufficiently skilled in the art of nice composition to enable them to accurately draft their own specifications. They must, therefore, resort to others; and it not unfrequently happens that the draftsman employed to describe a particular invention, either through want of skill or from haste or ignorance of the state of the art, gives, in the specification, a very imperfect description of the thing invented. He sometimes narrows the scope of the inventor's ideas and combinations, and at other times expands them over instruments and devices which are not the product of his original thoughts'.

[245] *Wollensak* v *Reiher* 115 U.S. 96, 99 (1885). Commenting on this, Robinson observes that not ordinary affairs: 'This seems to assume that if an idea is clearly perceived by the mind it can always be so expressed in words as to infallibly present to other minds the same idea – which is not true, especially in reference to conceptions in science and art. An inventor may believe that his Claims exactly cover his invention, but it does not follow that the judicial mind will arrive at the same conclusion' (vol 2, at p 403).

probable that the defect in the specification can be so apparent as to be perceived by any but those who examine it for the purpose of pirating the invention'.[246] Perhaps this argument made some sense at a time when patent texts did not circulate very widely, and when the models collected in the Patent Office were the most accessible embodiments of invention, but by the last quarter of the nineteenth century it had been completely reversed. In 1881 the Supreme Court complained that: 'Patents have been so expanded and idealized, years after their first issue, that hundreds and thousands of mechanics and manufactures, who had just reason to suppose that the field of action was open, have been obliged to discontinue their employments, or to pay an enormous tax for continuing them'.[247] Here we see a convergence between the question of reissues and the evolution of the modern form of patent claim. Reissues were characterized as exceptions to the strict principle that a patentee should be deemed to have abandoned or disclaimed those parts or aspects of the invention that were omitted from his claims:

> [A claim] is a declaration that that which is not claimed is either not the patentee's invention, or, if his, he dedicates it to the public. This legal effect of the patent cannot be revoked unless the patentee surrenders it and proves that the specification was framed by real inadvertence, accident, or mistake, without any fraudulent or deceptive intention on his part; and this should be with all due diligence or speed.[248]

This statement recapitulated two principles that had emerged in earlier decisions: first, there could be no reissue unless the patentee had made a genuine mistake,[249] second the idea that the even where there had been such a mistake, the patentee had to seek a reissue within a reasonable period of time, which was notionally fixed at two years (apparently by analogy with the rule that inventors had two years from reduction to practice to file a patent application if they were not to lose priority of invention).[250] Doctrinally, the effect was to make it almost impossible to use reissue procedure to expand the scope of a patent claim.[251]

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[246] Grant v raymond, at p 243.

[247] Miller v Brass Co 104 U.S. 350, 355 (1881).

[248] *Miller* v *Brass Co.* 104 U.S. 350, 352 (1881).

[249] '[A] clear mistake, inadvertently committed in the wording of the claim, is necessary, without reference to the length of time' (*Coon* v *Wilson* 113 U.S. 268, 277 (1884)). And ref Topliff

[250] Robinson's theory here was that not really about timing, that patentees could be mistaken and genuineluy believe that they had covered, and even if 'more mature experience or the subsequent decisions of the courts' (vol 2, 396) could prove him wrong, the better rule was to tie the delay to the question attitude at the outset – the abandon was original – and restrained to 'the doctrine that an original intention to abandon is indicated by a failure to correct the omission or misstatement as soon as it is broght home to the knowledge of the patentee' (vol 2, 397).

[251] Ref to modern day

**Text as norm**

Historically, these doctrinal formulations facilitated the embodiment and circulation of inventions in text. Textualization was premised on a number of technical developments – the large-scale lithographic reproduction of texts, the refinement of conventions of technical drawing and description, the development of an efficient postal system[252] – but these conditions had to be completed by a legal theory of the invention as a textual artifact. The materiality of texts was something more than a practical or technological fact; it was also, and more importantly perhaps, an effect of the way that texts were apprehended and construed in legal discourse. The way(s) in which something is observed and thematized becomes an ingredient of its materiality.[253] In that sense, paradoxically, the medium was conditioned by the communicative exchanges that it made possible. Patent jurisprudence 'normalized' the patent text by endorsing the normative effects of technical form and interpretive convention, by justifying the partiality of textual reference, and by binding readers of patents to the interpretation of the text that would have been arrived at by the normative-fictional reader – the person having ordinary skill in the art. The representation of the inventor as a person doubly skilled in the legal and mechanical arts was central to this mode of normalization. To begin with, the theory of the competent inventor allowed the inherent partiality or selectivity of texts to be passed off as a consequence of personal and institutional choices. Crudely, by attributing the partiality of textual reference to the acts or oversights of a self-interested actor patent jurisprudence was able to hold on to the commonsense myth of correspondence between names and things.[254] Texts were partial in the weak sense that they captured only that aspect of the thing which the inventor had managed to convey, not in the more fundamental sense that they set up the phenomenological horizon within which the invention existed. More concretely, the theory of the doubly-skilled inventor facilitated the differentiation of patent jurisprudence from mechanical knowledge, and it enabled jurisprudence to externalize any representation of invention that was not already coded in terms of its potential relevance to law.

This points to a difference between the agency of models and the agency of claims. Patent models were the means by which, to return to Justice Story's formula, patent jurisprudence distinguished 'matter of law' from 'mechanical opinion'. In the era of the patent model this process of reciprocal translation took place within the frame of the trial. And because there few codes or conventions by which to assign a legal meaning to mechanical features, or because conventions of this sort were

[252] See generally Rankin

[253] Scheffer, materiliaties have to include their observation.

[254] Which we still find today. See Supreme Court and Lemley

matters of 'common sense', the process of translation was always taken up afresh in each case. The emergence of the claim changed things quite fundamentally: when mechanical form was introduced into a trial it was already coded in legal terms. Again, the fiction of the person having ordinary skill in the art played a central role in this process. First, as persons skilled in both the legal and the mechanical arts inventors could be held responsible for translating science into law. The author-inventor was supposed to have addressed the text to the ideal reader – the person skilled in the art – and to have coded the specification of the invention accordingly. Second, because claims were assertive rather than merely descriptive the question for adjudication was not what the 'real' nature of the invention was, but whether a given mechanical feature could bear the legal significance claimed for it by the inventor. And as the decisions on the limits of reissues make clear, even if an invention was 'really' novel the patentee would be held to what was publicly and effectively claimed.[255] One might say, of course, that the plausibility of a vindicatory definition could not be assessed without first establishing the true form of the invention, but the point is that the invention was only ever seen through (partial) texts. Third, this kind of technical description worked because the form of the claim and the associated drawings was so intensely codified: the patent claim was expressed in terms of 'elements' that translated mechanical components into semantic components, and these elements were indexed to the drawings in such a way as to qualify those drawings in legal terms. The upshot was that the form of the patent text itself had normative effects: the materiality of the text configured mechanical form in such a way that it was already, even before argument began, cast in terms of its legal significance. That is not to say that the relation between 'matter of law' from 'mechanical opinion' was not open to negotiation: in the next chapter we explore how the modern patent claim functions as a kind of 'dynamogramme'[256] or as medium for what doctrinal commentators call 'quantum patent mechanics'.[257] For now, the point is only that models and claims are different means of fabrication.

**The eclipse of the model**

Before 1832 the Patent Office was effectively a collecting and forwarding agency, which referred patents to the courts for a real determination of substantive questions of scope and validity.[258] When the Patent Office resumed the substantive examination of patent applications things changed: patent texts began to reach the courts as records of an administrative judgment as to novelty or adequacy of

[255] Doctrine of equivalemnts???
[256] To borrow a phrase from Aby Warburg, cited in agamben
[257] Burk & lemley
[258] Of course it was more than that preicely because of the toy shop.

disclosure. Where (as was often the case) an infringement action was premised on a reissued patent, the defendant would usually contest the validity of the reissue, which meant that the court had to review the decision of a patent examiner. Formally, the question was whether there had been some mistaken exercise of the Office's jurisdiction.[259] But how was mistake to be determined? The Patent Office and the courts were both supposed to apply the same legal principles in determining whether a reissue was justified.[260] But the question of law – was the reissue for the 'same invention' as that which was described in the original patent? – was actually a question about facts: what kinds of evidence should be admissible and how should that evidence be interpreted? So in the process of deciding a question of law the courts were effectively reaching back into the process of examination to prescribe how the evidence should inform the fabrication of a text. It might have seemed that the question that engaged judicial review – as a matter of legal construction, was it obvious from the face of the documents that the reissued patent was not for the 'same' invention as that which was designated by the original patent?[261] – conceded too much authority to the patent examiner.[262] But by limiting the initial terms of review to what appeared on the surface of text, patent jurisprudence effectively turned this surface plane into the primary medium of invention. From the perspective of the court, beginning with the finished text, the question was whether a surface discrepancy between the text of the reissue and the original patent text could be justified by reference to the record of proceedings in the Patent Office. Because these proceedings could be brought to the courtroom only

[259] The Commissioner of Patents had statutory authority to grant reissues, but this authority gave no real guidance as to what the statdabnrsd or crieteri were. The patent act of 1836 stated only that the Commissioner had authority 'to cause a new patent to be issued to the [inventor], for the same invention' (Patent Act, 1836, section 13) but offered no criteri as to the same, and the act of 1870 added that in the case f machine patents th emdel pr specification, and elsewhere that 'amendments may be made upon proof satisfactory to the commissioner that such new matter or amendment was a part of the original invention' (Patent Act 1870, section 53: [No] new matter shall be introduced into the specification, nor in case of a machine patent shall the model or drawings be amended, except each by the other; but when there is neither model nor drawing, amendments may be made upon proof satisfactory to the commissioner that such new matter or amendment was a part of the original invention, and was omitted from the specification by inadvertence, accident, or mistake'). The Commissioner of Patents had statutory authority to grant reissues intitial view was that the Commissioner should be presumed to have acted within his authority, and that this presumption could be rebutted only by evidence of fraud, either in the sense of collusion between the patentee and the patent office, or in the sense that the patent office was the instrument of a fraud practiced by the patentee. See, for example, *Smith* v *Merriam* 6 Fed Rep 713, 717-718 (1881): 'I know that the courts have called these mistakes jurisdictional. They did this to overrule, without positively saying so, the early cases which held the action of the commissioner within his jurisdiction to be final. It is obvious that the commissioner has the same jurisdiction to issue a bad patent as to issue a good one. A mistake by him as to the necessity of issuing a new patent is not an excess of jurisdiction, but a mistake in mater clearly within his jurisdiction; and the real question is whether it is one which the courts will correct by destroying a new patent after the old one has been surrendered'. .[1] As the opportunistic use of reissues increased, apparently facilitated by the gullibility of patent examiners, the test became a straightfo4ward question whether

[260] See Robinson book 3 at 330.

[261] The classic test was set out in *Seymour* v *Osborne* (1870): 'Where the Commissioner accepts a surrender of an original patent and grants a new patent, his decision in the premises, on a suit for infringement, is final and conclusive, and it is not re-examinable in such a suit in the Circuit Court, unless it is apparent upon the face of the patent that he has exceeded his authority, that there is such a repugnancy between the old and the new patent that it must be held, as a matter of legal construction, that the new patent is not for the same invention as that embraced and secured in the original patent'.

[262] For example, William Robinson argued that this limitation stemmed from 'an exaggerated view of the authority of the Commissioner', (vol 2 454).

in the form of a textual record, the process of judicial review consisted in holding one text to the light of another.

Patent examiners had good reason to look for something other than text. From the perspective of the examiner, it would rarely have been productive to compare the original patent text and the reissue application. The purpose of the reissue application was to correct an error in the original patent, and given that most reissues sought to expand the original patent the alleged error would almost always have taken the form of an omission. How could one decide the validity of an amendment correcting an omission unless one had some external, non-textual, point of reference? This problem was compounded by the fact that reissue proceedings were very rarely contested,[263] so that the evidence available to the examiner was either the evidence offered by the applicant or such evidence as was held in the archives of the Patent Office. There were essentially four kinds of evidence: witness testimony, a manufactured embodiment of the invention, the patent drawings, and the Office model. Strictly speaking, only the drawings qualified as component parts of the original patent, but because they were taken to be rawer than text, closer to thing itself, both the drawings and the model acquired a particular role in reissue proceedings. For example, evidence as to how the manufactured artifact worked in the real world had to be conveyed by means of testimony, and testimony was always suspect.[264] Models and drawings, by contrast, could speak for themselves. Already, within the process of original examination, the model and the drawings were separated out from the other elements of the application and held steady throughout the examination procedure as a horizon against which proposed amendments or additions to the written parts of the application could be evaluated.[265] It is likely that models and drawings played exactly the same role in relation to post-issue amendments as they did in relation to pre-issue amendments. As textualization progressed, and in particular as conventions of patent drawing became closely standardized, the drawing replaced the model as an internal foil or counterpoint to writing. But for so long as models remained a widely-used and widely-understood means of communicating invention the Patent Office model was still, for many, the most complete form of evidence. In 1849 the *Scientific American* observed that the practice of the Patent

[263] Exception for interference proceedings where two reissue conflicts with invention alleged to have effective priority over the oogi9anl of th eoresiuse.

[264] One coud have testimony – the idea that wirnesses could illuiminateor speak to documents but this was problematic In 1852 the patent office issued rules stating that a reissue with broadened claims could not be granted unless it was 'clearly and conclusively shown by testimony, other than that of the parties or others interested, that the [newly-claimed features] were embraced in the original machine or thing patented'Dood, 'Pursuing the essence of inventions', at 1008. For examples of use of expert witnesses se cases -

[265] See, for example, the observation in *Singer* v *Braunsdorf* 22 F.Cas. 196, 199 (1870): 'The specification is always open to amendment of its descriptions and claims, and to the addition of new matters of description and new claims, where the drawings and model exhibit the matters involved in the amendments and additions; and this privilege continues until the matter of the application is finally disposed of, by the granting of a patent, or otherwise'.

Office was 'to grant no claim on a reissue except for something exhibited on the model or original specification',[266] and it is reasonable to surmise that the model was the more important of the two.

In the context of adjudication, however, the relation between model and text was gradually reversed: the model figured not as the ultimate warrant of a textual description but as evidence to corroborate what was written in text. Just as the invention itself was always seen through (partial) texts, so too was the model. A decision of 1873, which concerned a reissued patent for an improved harvesting machine, offers a nice illustration.[267] According to the specification of the reissue one of the novelties of the machine was an oscillating beam or 'finger-bar' that enabled the harvester to negotiate rough terrain. The defendant argued that this distinctive movement was not disclosed in any part of the original patent, and that the oscillating finger-bar was therefore new matter that invalidated the reissued patent: the reissue was not for the same invention as that designated by the original patent. Although this was an opportunistic defense to an otherwise irrefutable charge of infringement, it directly engaged the question whether the Patent Office model could validate a reissue. The court started by observing that the operation of the finger-bar had not been clearly defined in the original specification, but that if its distinctive action could be established on other grounds the silence of the specification was 'not only no objection to the validity of a reissue, but it furnished a just and proper occasion therefor'.[268] Given that the patent drawings were no clearer than the specification, the patent model was offered as the best evidence of the original invention. The court admitted as evidence a certified copy of the Office model, but damage to the original model meant that it no longer showed the finger-bar. At this point, the original model in its unimpaired condition made a spectral appearance. The court started from the inference that the finger-bar was so important that it must have been shown in the original model, which had accompanied the patent from the first issue through subsequent reissues. More importantly, the record of proceedings relating to the application for the contested reissue showed that the examiner had raised precisely the objection raised by the defendants and had withdrawn the objection when the applicant referred him to the original (and at that point still unimpaired) model as proof of what was claimed in the amended specification. Although in one sense this decision affirmed the originality of the model as evidence of what was originally patented, it also revealed the new function of the model as a secondary control on text or as a corroboration of what was asserted in a text.

[266] Dood, Patent Models, Part II, 65 JPOS 234, at 253.
[267] See *Aultman* v *Holley* 2 F.Cas. 217 (1873).
[268] *Aultman* v *Holley* 2 F.Cas. 217, 223 (1873).

The eclipse of models by texts was not the effect of a linear development in patent jurisprudence. As late as 1877 a court reviewing the validity of a reissued patent affirmed that the Patent Office model might serve as the most original evidence of the invention: 'anything appearing in the model, which is the embodiment by the patentee of his invention, can hardly come within the designation of new matter in the reissue, because it is not fully described in the claim, specifications and drawings of the original'.[269] But by this time the materiality of models – the very quality that recommended them to the curators of *The Useful Cabinet* – was beginning to seem less durable or malleable than the materiality of text. As things turned out, a model could be forged more easily than a text or drawing:

> Why, look at these little models in the Patent Office. Many of them represent a walking-beam, for instance, by a piece of metal no bigger than a pen-holder; a thing which may be broken, twisted, bent, altered in various ways by the fingers. Other pieces are represented by little pieces of wood glued to other pieces of wood. They may come apart. Material alterations may be made by accident or design in these models. No man can tell whether the models originally were filed as they appear today. Perhaps – and upon these alterations I speak advisedly from instances which I know have happened – upon those models, altered in that fashion, new descriptions of new inventions, which never existed in the mind of the patentee, are incorporated into the new patent and the public are made to suffer.[270]

This was just a further reason for refusing to allow inventors (or, more likely, their assignees) to return to the patent model to justify a reissue. It reinforced a more widely expressed concern, which was that even if models remained materially intact the institutional memory of the Patent Office was essentially inconstant.[271] So the very qualities that made models so effective and expressive in the

[269] *Reissner* v *Anness* 3 Ban. & A. 176, 20 F.Cas. 513, 514 (1877). The full quote is as follows: 'The counsel for the defendants objects to a resort to the patent office model in determining what was described in the original patent. But this is clearly allowable. The object of the reissue, and the reason why the right is given, are to correct defective or insufficient specifications, whereby the patent is inoperative or invalid, and anything appearing in the model, which is the embodiment by the patentee of his invention, can hardly come within the designation of new matter in the reissue, because it is not fully described in the claim, specifications and drawings of the original'.

[270] 1878 report, at p 59. Echoed by another witness – the at p 153: '[I]t may be very material to a machine whether a certain joint is a rigid joint, permitting no motion, or whether it is a movable joint. Suppose you have a wooden model, glued together, and it is broken, how are you going to tell whether that was a fixed joint incapable of doing certain work or a movable joint capable of doing it? If you were to reissue by models you would reissue by broken models, and have to supply the parts by conjecture or affidavits, and you would open the door to fraud'.

[271] 'A reissue can only be granted for the same invention which was originally patented. If it were otherwise, a door would be opened to the admission of the greatest frauds. Claims and pretensions shown to be unfounded at the time might, after the lapse of few years, a change in officers in the Patent Office, the death of witnesses, and the dispersion of documents, be set up anew, and a reversal of the first decision obtained without an appeal, and without any knowledge of the previous investigations on the subject' (*Manufacturing Co* v *Ladd* 102 U.S. 408, 413 (1880)). This concern was also expressed from within the Office itself: '[T]here is no section of the patent law so often sought to be misused and abused as that in reference to reissues. A patentee, finding that some person has made an improvement upon his invention, rushes to the Patent Office, and by reissue, seeks to cover his neighbor's improvement. Another comes to the Office and seeks a broad, sweeping, claim, but is required to limit his specification and claims to exactly what he has invented, and gets a patent with a claim much narrower than he sought but fully covering all he has invented. He then watches to find the examiner sick or

context of litigation now came to be seen as faults that were open to exploitation by fraudulent patentees. It was against this background that the *New York Times* in 1879 made the objection that 'the law allows the Patent Office model to be used in the preparation of the amended specification for a reissue, instead of confining the applicant to the original description and drawings'.[272]

Patent jurisprudence finally banished models as the premises of reissues in 1887, in the decision of the Supreme Court in *Parker & Whipple Company* v *Yale Clock Company*.[273] In 1879 the Connecticut inventor Arthur Hotchkiss took out a patent for the invention of a miniature pendulum clock, but in his patent he omitted to claim the most inventive part of his device, which was the particular arrangement of the clockwork mechanism. In 1880 Hotchkiss assigned his patent to the Parker & Whipple Company, which then licensed production of the clock to the Yale Clock Company.[274] Having put the Hotchkiss clock into production, the superintendent of the Yale Clock Company, Frederick Lane, patented (in 1881) a miniature clock that reproduced the innovative clockwork mechanism of the Hotchkiss clock but did not reproduce any of the elements actually claimed by Hotchkiss in his patent. The Yale Company manufactured and sold both the Hotchkiss clock and the Lane clock. Hotchkiss immediately sought a reissue[275] of his original patent, in which the claims were expanded to cover his novel arrangement of the clockwork mechanism. The reissue was granted by the Patent Office on the basis that the original model quite clearly showed the feature that was claimed in the reissue. When the resulting infringement action reached the Supreme Court, the Court did not deny the factual premise of the decision made by the examiner, but still insisted that the inventor should be held to the terms of his original claim:

> [W]hile the new description may properly contain things which are indicated in the original specification, drawings, or patent-office model (though not sufficiently described in the original specification), it does not follow that what was indicated in the original specification, drawings, or patent-office model is to be considered as a part of the invention, unless the court can see, from a comparison of the two patents, that the original patent embodied, as the invention intended to be secured by it, what the claims of the reissue are intended to cover.[276]

away on leave of absence and a less skilful man occupying his place, when he comes back and seeks a reissue to obtain all that was refused him at first. This sharp practice has become so prolific a source of swindling, that the Office is compelled to adhere to the very letter of the law – to construe it as literally as a court would a criminal statute' (Commissioner of Patents, in *Ex parte Waring* (1871), cited in Dood, Part II, at pp 258-259).

272 The patent bill, *New York Times*, January 11 1879.

273 Ref, and fo rth efacts see also Dood, models, part II, at pp 259-260.

274 (one of the terms of the license was that Yale should supply the necessary machine tools and dies for making the clock, which suggests that the had the eafctayring equioement an dxx.

275 Although Hotchkiss had assigned his patent, the statutes stipulated that the inevtor if alive had ot eb aparty to the reissue application evuas eit involved swearing an oath as to wehat was really invented.

276 *Parker & Whipple Co* v *Yale Clock Co* 123 US 87, xx (1887).

The Patent Office model could be invoked only to corroborate an assertion that was evident on the face of the original patent specification, construed without reference to the model. What was revealed in the model was irrelevant 'unless the original specification indicated that [the salient features of the model] were embraced in the invention intended to have been secured by the original patent'.[277]

Again, by referring to intention, and to the inventor doubly skilled in the legal and mechanical arts, patent jurisprudence was able to cut patent texts away from the raw facts to which they were supposed to refer. What mattered was not the axis of reference – the relation between the text and the thing – but the axis of communication: what sense of the invention had the patent text effectively communicated to the public? In the late nineteenth century decisions on the validity of reissues judicial opinions compared the claims in the original patent with those in the contested reissue by printing them in parallel columns, italicizing the differences between the two texts. This illustrates – both figuratively and literally – how the axis of reference was absorbed into the plane of texts: a relation between word and world had become a relation between word and word. But how did this jurisprudential development affect the Patent Office? There may be a simple answer. Given that the term of a patent was then seventeen years,[278] and given that few original patent applications made after 1880 would have been accompanied by models, by the end of the nineteenth century any patentee seeking a reissue would have been unable to return to a model but only to texts and drawings. After this old models lived on as evidential resources, although this was probably more in the imagination or interests of early twentieth century patent lawyers than in practical reality. So what now remains of the patent model as a normative engine? Although the Patent Office still permits inventors to use models to explain their invention to a patent examiner, the model must be removed as soon as the interview is concluded, and no trace of it must remain other than a documentary record of its significance.[279] What remains, perhaps, is the specter of the model, the sense of the invention as a contingent and modulable 'combination'. We turn now to the question of how this spectral archetype survived into the form of the modern patent claim.

[277] *Flower* v *Detroit* 127 US 563, 571 (1887).
[278] S 22 of 1870 act.
[279] See MPEP 608.03(a).