ORGANISMS AND MANUFACTURES: ON THE HISTORY OF PLANT INVENTIONS

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[This article examines the nature of the invention in intellectual property law. Taking the United States' Plant Patent Act of 1930 *as its central focus, it explores the terms in which the compatibility of biological inventions with the modern paradigm of the invention was debated in the first part of the 20th century. The questions addressed in the debates leading up to the enactment of the* Plant Patent Act of 1930 *— what kinds of plant qualified as patentable subject matter; what exactly did a breeder have to do in order to qualify as an inventor; and what was the relationship between the act of invention and the act of reproducing the invention — were ultimately questions about the consistency of ideas and the nature of manufacture, the answers to which are as pertinent today as they were some 80 years ago. We argue that in answering these questions, the traditional notion of the invention was redefined. Whereas traditional utility patents were based on the assumption that the only actor able to exercise agency in relation to the development of a novel invention was the human inventor, the regime of plant patents acknowledged that nature played a key role in the creation of new plant varieties. By altering the concept of agency that underpins the inventive process within patent law, plant patent law fundamentally changed the way that the invention was configured. In particular, whereas mechanical inventors were inventors at the beginning, breeders were inventors after the fact. At the same time, plant patent law also reversed the roles normally played by the participants involved in the creation of the invention. Under traditional patent doctrine, nature provided the material which was then shaped into an invention by the human inventor. In the case of plant patents, nature did the inventing, and the breeder was relegated to the task of identifying and then reproducing nature's creations. One of the consequences of this is that breeders did not create a new genetic principle — instead, they inductively appropriated a natural event. This changed the premise of invention — invention became an inductive rather than an originating act. Using the doctrinal requirement of enablement as a case study, we show how the reconfiguration of the invention had and continues to have important ramifications for the way that plant inventions, as with biological inventions more generally, are dealt with by intellectual property law.]*

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I INTRODUCTION

Although critical attention is more often directed to the role of patents in such things as stem cell research, pharmaceuticals or human cloning, an exploration of the geographical and historical trajectories of plant inventions remains a produc-

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tive (and under-exploited) approach to the study of biological invention. Transgenic plants are the most widely travelled and cosmopolitan embodiments of biotechnological ingenuity.[1] They originate in the laboratories of agricultural biotechnology corporations and are exported to markets in diverse parts of the globe. Even the relatively minor displacement from the laboratory to the fields of North American farmers has raised difficult questions for intellectual property law. In Canada, for example, patents relating to transgenic plants cannot claim the modified plants as exemplars of a new variety; they can only claim the gene construct that confers the desired trait upon each plant.[2] As a result, courts have had to consider whether — or to what extent — a patent controlling the use and reproduction of the gene construct also controls the use and reproduction of the whole plant.[3] They have also had to consider how the respective contributions of biotechnological ingenuity and biological process should be quantified. What are the limits of 'manufacture'? The material substance of the plant is qualified by two distinct modes of creation and reproduction, and patent doctrine can only reconcile these principles of origin by recourse to crude pragmatism: to reproduce the plant is necessarily to reproduce the construct that it 'embodies'. So plant inventions — precisely because the patent effectively claims a whole organism rather than an isolated gene sequence or metabolic mechanism of action[4] — press home a question that is posed only implicitly or obliquely by other kinds of biotechnological invention:[5] where does natural process end and 'invention' begin?

Transgenic plants are not designed or bred entirely de novo: the basic technique of modification consists in adding a specific trait or competence to a variety produced by 'natural' processes of breeding and selection.[6] Commercial breeding programmes are dependent on access to genetic resources that are drawn from many diversity-rich parts of the world, often in the South, and which are maintained ex situ in public seed banks.[7] As a result, the agronomic value of elite varieties (in terms of yield performance) is essentially a function of their cosmopolitan nature — it is estimated that even the most genealogically uncomplicated variety will be composed of at least 30 parent lines.[8] Transgenic modification often adds nothing more than a protective packaging to this

1 See generally Londa Schiebinger, *Plants and Empire: Colonial Bioprospecting in the Atlantic World* (2004); Lucile H Brockway, *Science and Colonial Expansion: The Role of the British Royal Botanic Gardens* (2002).

2 *Monsanto Canada Inc v Schmeiser* [2004] 1 SCR 902, 914 (McLachlin CJ and Fish J), 941 (Arbour J) ('*Schmeiser*').

3 See ibid 918, 931 (McLachlin CJ and Fish J), 954 (Arbour J).

4 Ibid 921, 932 (McLachlin CJ and Fish J), 956 (Arbour J).

5 In the United States, there is still no settled judicial view as to how biological inventions can be reconciled with the written description requirement of US patent law. See generally Joseph M Manak, 'The Law of Written Description in Pharmaceutical and Biotechnology Patents' (2004) 23 *Biotechnology Law Report* 30.

6 For a general discussion: see Jack Brown and Peter Caligari, *An Introduction to Plant Breeding* (2007, forthcoming).

7 For a general discussion see: A H D Brown et al, *The Use of Plant Genetic Resources* (1989).

8 Timothy Swanson and Timo Goeschl, 'Diffusion and Distribution: The Impacts on Poor Countries of Technological Enforcement within the Biotechnology Sector' in Keith E Maskus and Jerome H Reichman (eds), *International Public Goods and Transfer of Technology under a Globalized Intellectual Property Regime* (2005) 669, 673.

complex product. An elite variety produced by selective breeding has a typical lifespan of five to seven years,[9] which is about the amount of time it takes for species of insect or bacteria to adapt themselves to resistances bred into the variety. So plant breeders are engaged in continuous breeding programmes with the objective of finding ever new kinds of resistant strain. Biotechnology allows resistances to pests and diseases to be engineered into the elite variety, either by means of a gene that confers resistance to a specific pathogen, or to a proprietary herbicide or pesticide. So transgenic plants, including those that are protected by 'genetic use restriction technologies' ('GURTs'), merely bundle up the same cosmopolitan source lines that are found in conventional varieties, with the lines being drawn from either the public domain as it existed before genetic resources became subject to state sovereignty, or some sovereign jurisdiction. By what principle of accounting should one recognise these different contributions? To what extent do proprietary transgenic plants enclose essentially public resources? Legal instruments such as the *International Treaty on Plant Genetic Resources for Food and Agriculture* attempt to address these questions,[10] but their effectiveness is compromised by the fact that there are not only too many claims to ownership in play, but also too many conceptions of ownership.

The fundamental problem is that plant inventions — whether conventional or transgenic — compress diverse economic, cultural, and legal contexts. A single plant is an index to many different principles of origination, many potential owners, and many different modes of scientific or therapeutic knowledge. And biotechnology has played a leading role in this process of global expansion and cultural diffraction. The case of 'biopiracy' or 'bioprospecting' is a good illustration. In the classic form of bioprospecting, biotechnology corporations exploit indigenous ethnobotanical knowledge to identify plants with promising pharmaceutical potential. In the rare cases in which bioprospecting pays real dividends, the plants are reduced to chemical compounds and then packaged and patented as pharmaceuticals.[11] Natural products research, as a specific mode of biotechnological research, sets up a long and convoluted chain of relatedness between laboratory science and indigenous knowledge. Of course, bioprospecting practices were prevalent well before the rise of biotechnology, and it is arguable that these practices always generated new kinds of cultural mixture.[12] However, whereas these forms of cultural complexity could once have been externalised by the patent system, they now have to be absorbed into the doctrinal explanation of patent rights.[13] Bioprospecting not only forces different economies of knowledge into proximity, in doing so it also complicates the

9 Ibid.

10 Opened for signature 3 November 2001, [2006] ATS 10 (entered into force 29 June 2004).

11 See, eg, Peter Jaszi and Martha Woodmansee, 'Beyond Authorship: Reconfiguring Rights in Traditional Culture and Bioknowledge' in Mario Biagioli and Peter Galison (eds), *Scientific Authorship: Credit and Intellectual Property in Science* (2003) 195, 200.

12 See Schiebinger, above n 1.

13 This is a direct product of both the *Convention on Biological Diversity*, opened for signature 5 June 1992, 1760 UNTS 79 (entered into force 29 December 1993), and the *International Treaty on Plant Genetic Resources for Food and Agriculture*, opened for signature 3 November 2001, [2002] ATNIF 14 (entered into force 29 June 2004), which attempt to integrate the use of plant genetic resources and intellectual property law.

Western doctrinal conception of 'inventorship'. What is in question is not just the entitlement of indigenous peoples as the custodians or cultivators of the plant material, but also their entitlement as the 'authors' or 'breeders' of these plants. This kind of authorship cannot be easily explained in terms of the familiar Western conception of technical innovation or justified in terms of notions of economic and social utility; rather, intellectual property law must experiment with elements of authorship that are drawn from discourses such as human rights.[14]

What one sees in these examples is the diffraction of plants into a number of distinct legal entities, and although this process is driven by economic, political and technical forces that are specific to plant inventions, there is a sense in which these complexities express a tension that is common to all biological inventions. The lines along which plant inventions fall apart can be retraced to the basic doctrinal distinction between intangible and tangible, form and matter, or idea and embodiment. The contemporary complexity of plant inventions arises from the fact that the dimension of the intangible is diffracted into multiple principles of origination or authorship, which in turn divide the material form of the plant into multiple embodiments. In modern patent law, the distinction between the mental and the material was stabilised by a number of mutually-reinforcing manoeuvres: the reduction of the inventive idea to text; the separation of the dimension of the invention from the process of manufacturing and marketing; and the consequent reduction of material form to a mere embodiment of the invention.[15] The trouble with biological inventions is that they cannot be easily divided into such neat, mutually exclusive registers: the metabolic processes of living organisms cannot be reduced to anything resembling an engineering blueprint, so the inventive idea cannot be clearly delineated and distinguished from the process in which it intervenes. The idea is not reducible to text, but remains embedded in, and animated by, the tissues in which it is expressed, and as the *Schmeiser* decision suggests, it is impossible to say where the formative power of the idea ends and where natural biological process begins. Patent law may be committed to making the distinction between ideas and embodiments, but as a result, it is compelled to search within the texture of the invention for a dividing line that can ultimately only be a line of its own making. Hence, the endless diffraction of the invention itself.

In this article, we explore the question of invention and animate embodiments by retracing the historical — as opposed to the geographical — trajectory of patents for invented plants. To this end, we re-examine both the United States' *Plant Patent Act of 1930*,[16] and more generally, the historical period in which it was enacted, when, as now, the compatibility of biological inventions with the modern paradigm of the 'invention' was being explored. The questions addressed in the debates leading up to the enactment of the US *Plant Patent Act of 1930* — what

14 See Rosemary Coombe, 'Works in Progress: Traditional Knowledge, Biological Diversity, and Intellectual Property in a Neoliberal Era' in Richard W Perry and Bill Maurer (eds), *Globalization under Construction: Governmentality, Law and Identity* (2003) 273.

15 See generally Mario Biagioli, 'Patent Republic: Representing Inventions, Constructing Rights and Authors' (2006) 73 *Social Research* 1129, 1143.

16 Pub L No 245, 46 Stat 376. For the current version: see 35 USC §§ 161–4 (2000 & Supp IV, 2005).

kinds of plant qualified as patentable subject matter; what exactly did a breeder have to do in order to qualify as an inventor; and what was the relationship between the act of invention and the act of reproducing the invention — were ultimately questions about the consistency of ideas and the nature of manufacture, the answers to which are as pertinent today as they were some 80 years ago.

II Mechanising Nature

In historical accounts, the *Plant Patent Act of 1930* is often presented as a kind of parallel to the scheme of utility patents — plant inventions were crudely compared with mechanical and chemical inventions, but the differences between manufactures and organisms were still too marked to allow the inclusion of plants in the general patent statute:

> social agents failed in their attempts simply to amend the utility patent statutes to include plants. Instead, a *sui generis* statute was created, one which allowed lax descriptions of the invention, a liberal policy regarding discoveries, and no clear indication that the new plant variety constituted an improvement over existing ones.[17]

The *Plant Patent Act of 1930* extended patents to plants, but it did so only by analogy, establishing a species of patent right that addressed plant inventions as exceptions or approximations to mechanical or chemical inventions. In this reading of history, the Act was eclipsed by the decision of the US Supreme Court in *Diamond v Chakrabarty* ('*Chakrabarty*'), which in a single act of judicial legislation expanded the system of utility patents to include living inventions.[18] The broad premise of the decision in *Chakrabarty* — that 'anything under the sun that is [novel and] made by man'[19] is patentable — implied that there was no longer any justification for excluding plants from the general patent system and sequestering them in the regime of patent rights or plant variety rights.[20] In response, the US Patent Office almost immediately started to grant utility patents in respect of plants, and it seemed that all prior objections to the patenting of plants and living organisms were either merely procedural or premised on an outdated technological vision: 'The questions that had been raised for decades over protection of plants were suddenly irrelevant for perhaps all living things.'[21]

In the US, the decision in *Chakrabarty* effectively curtailed fundamental doctrinal questions about the patentability of biological and biotechnological inventions. The formal legal question in the case[22] was whether a genetically engineered bacterium could qualify as a 'manufacture' or a 'composition of matter' within the terms of the US *Patent Act of 1952*.[23] Referring to the text of the *Patent Act*, which prescribes that patents might be issued for 'any new and

17 Cary Fowler, *Unnatural Selection: Technology, Politics, and Plant Evolution* (1994) 93.
18 447 US 303, 318 (Burger CJ for the Court) (1980).
19 Ibid 309 (Burger CJ for the Court).
20 Ibid.
21 Fowler, above n 17, 150.
22 *Chakrabarty*, 447 US 303, 307 (Burger CJ for the Court) (1980).
23 Pub L No 593, 66 Stat 792. For the current version: see 35 USC § 100–376 (2000 & Supp IV, 2005). See especially 35 USC § 101 (2000 & Supp IV, 2005).

useful process, machine, manufacture, or composition of matter',[24] a majority in the US Supreme Court held that the meaning of the four subject matter limitations was governed by the prefatory term 'any': 'In choosing such expansive terms as "manufacture" and "composition of matter", modified by the comprehensive "any", Congress plainly contemplated that the patent laws would be given wide scope'.[25] If inventions were, by definition, new and non-obvious, then patent statutes should be ready for the unknowable, and should employ the most expansive language: 'Congress employed broad general language in drafting § 101 precisely because such inventions are often unforeseeable'.[26] The effect was to direct attention away from the definition of manufactures — the question of what mode of action or origination was implied in the terms 'composition' and 'manufacture' — and towards the question of novelty. The US Supreme Court affirmed the novelty of an invention, rather than its mode of origination or reproduction, as the essential qualification for patentability. A 'new' organism was every bit as 'novel' as a 'new' machine.

The approach taken in *Chakrabarty* was affirmed in relation to plant inventions by *J E M Ag Supply v Pioneer Hi-Bred* ('*Pioneer Hi-Bred*'),[27] in which a majority of the US Supreme Court held that plant inventions were eligible for utility patent protection. Significantly, the counter-argument before the US Supreme Court was not that plants were not manufactures or compositions of matter, but rather that the passing of the *Plant Patent Act of 1930* and the *Plant Variety Protection Act of 1970*[28] expressed a congressional intent to exclude plants from the scheme of utility patents. There is a sense in which an investigation of the meaning of 'manufacture' or 'composition of matter' was barred by *stare decisis*,[29] but the conceptual and doctrinal force of the decision was an effect of something more than formal principles of interpretation. By holding that living organisms were eligible for patent protection, the decision in *Chakrabarty* gave rise to the idea that there was no categorical difference between organisms and manufactures, and hence no need to define the limits of 'manufacture'.

This is not necessarily true of jurisdictions outside the US. For example, the question addressed by the Supreme Court of Canada in *Harvard College v Canada (Commissioner of Patents)*[30] was almost exactly the same as that addressed by the US Supreme Court in *Chakrabarty*: namely, was a genetically-engineered organism — in this case, a mouse — a 'manufacture' or a 'composition of matter' for the purposes of the Canadian *Patent Act*?[31] Unlike its

[24] 35 USC § 101 (2000 & Supp IV, 2005).
[25] *Chakrabarty*, 447 US 303, 308 (Burger CJ for the Court) (1980).
[26] Ibid 316 (Burger CJ for the Court).
[27] 534 US 124 (2001).
[28] Pub L No 91–577, 84 Stat 1542. For the current version: see 7 USC §§ 2321–583 (2000 & Supp V, 2006).
[29] *Pioneer Hi-Bred*, 534 US 124, 147 (Scalia J) (2001): 'Stare decisis … prevents us from any longer regarding as an open question — as ambiguous — whether "composition of matter" includes living things. *Diamond v Chakrabarty* … holds that it does.'
[30] [2002] 4 SCR 45, 83 (Binnie J for McLachlin CJC, Major and Arbour JJ).
[31] RSC 1985, c P-4.

US counterpart, the Canadian Supreme Court held that although the inventor had invented and 'manufactured' the gene construct that was inserted into each mouse embryo, the ultimate products (adult mice bearing the trait conferred by the construct) were grown through natural metabolic and ontogenetic processes.[32] This meant that the mouse as a whole could not be a 'manufacture' because its material form was not entirely structured or programmed by the patented 'idea'.[33] The response of one commentator in the US to this anxiety about the definition of a 'composition of matter' — 'one is left to wonder what else the mouse could possibly have been composed from'[34] — reveals the extent to which the *Chakrabarty* and *Pioneer Hi-Bred* decisions have narrowed the focus of legal doctrine. If in broader social and economic terms the effect of the decision in *Chakrabarty* was 'to normalize genetic engineering by providing forms and methods of discourse that made the applications of the technique seem amenable to control',[35] then in doctrinal terms the effect has been to cast the subject-matter limitations of the patent statute as codifications of policy choices, rather than expressions of a fundamental (if indeterminate) paradigm of invention.

The basic premise of the post-*Chakrabarty* approach to biological or biotechnological inventions is that biotechnology is the latest variation on the theme of instrumental, or instrumentalising, technology — just as the mechanical and chemical sciences instrumentalised inanimate nature, so biotechnology instrumentalises animate nature, and turns organisms into manufactures.[36]

Recent developments in fields such as synthetic biology[37] seem to confirm this analogy between biotechnological and mechanical knowledge; the image of synthetic biology as an exercise in 'engineering' building blocks and programmable logic gates synthesised from animate materials, extends the mechanical and instrumental vision of nature into the deep texture of life. However, doctrinal interpretations premised on this notion of instrumentality are partial in two ways. First, they only isolate one speculative strand of contemporary biotechnology, for example in biomedicine, instrumental approaches give no purchase on the complex, emergent dynamics of cellular metabolism.[38] Secondly, the presentation of biotechnology as a mode of mechanisation affirms and continues a trend in legal scholarship since *Chakrabarty*, which sees the question of biotechnology patents in normative rather than conceptual terms. Such an approach leaves little room for the study of the *Plant Patent Act of 1930*.

32 *Harvard College v Canada (Commissioner of Patents)* [2002] 4 SCR 45, 127 (Bastarache J for L'Heureux-Dubé, Gonthier, Iacobucci, Bastarache and LeBel JJ).

33 See ibid 130 (Bastarache J for L'Heureux-Dubé, Gonthier, Iacobucci, Bastarache and LeBel JJ).

34 Dan L Burk, 'The Problem of Process in Biotechnology' (2006) 43 *Houston Law Review* 561, 564.

35 Sheila Jasanoff, *Science at the Bar: Law, Science, and Technology in America* (1995) 140.

36 See Alain Pottage and Brad Sherman, 'Kinds, Clones, and Manufactures' in Mario Biagioli, Peter Jaszi and Martha Woodmansee (eds), *Contexts of Invention* (2008, forthcoming).

37 See generally, Paras Chopra and Akhil Kamma, 'Engineering Life through Synthetic Biology' (2006) 6 *In Silico Biology* 401; ETC Group, *Extreme Genetic Engineering: An Introduction to Synthetic Biology* (2006).

38 See The ENCODE Project Consortium, 'Identification and Analysis of Functional Elements in 1% of the Human Genome by the ENCODE Pilot Project' (2007) 447 *Nature* 799.

On the other hand, from the perspective of what might be called the 'conceptual fabrication' of patent rights,[39] a study of the Act is timely because it reveals a set of conceptual tensions that are still in play today, which centre on the distinctions between mechanisms and organisms, industrial manufacturing and biological reproduction, and texts and material objects.

It would be an exaggeration to say that the passing of the *Plant Patent Act of 1930* was driven by fundamental doctrinal arguments about the nature of invention. Instead, the legislation was effectively carried by a set of pragmatic arguments. In their efforts to eradicate the 'pirating' of new plant varieties,[40] having failed to obtain amendments to trade mark law that would have penalised the misuse of plant names,[41] the nursery industry proposed that the patent system should be extended to new plant varieties. The arguments made in support of this proposal were of a familiar kind. Not only would the new law alleviate the impoverished condition of plant breeders,[42] it would also stimulate private investment in breeding.[43] Anticipating arguments that were made in the latter part of the 20th century in respect of agricultural biotechnology, it was said that this legislative incentive would encourage the development of new and improved varieties, particularly those that were resistant to drought and cold.[44] And for those who remained unconvinced, it was suggested that by promoting investment in breeding, plant patents would not only lift the gloom that weighed on US agriculture[45] but also maintain public health, promote public safety and even enhance national defence.[46] Faced with a diminishing agricultural population, the beginning of the economic downturn that would become the Great Depression, concerns about the food supply, and the fact that the proposal aimed to 'do something for agriculture', it is not surprising that the plan to introduce plant patents met with little opposition.[47]

39 See generally Marilyn Strathern, 'Losing (Out on) Intellectual Resources' in Alain Pottage and Martha Mundy (eds), *Law, Anthropology, and the Constitution of the Social: Making Persons and Things* (2004) 201.

40 Agitation for plant patents was said to have begun in 1868: '200 New Plants Patented Since 1930' (January 1937) *Scientific American* 58, 59; Harry Goldsmith, 'Patents for Plant Inventors' (1937) 29 *Nature Magazine* 150; 'Patents of Plants' (1936) 84(2184) *Science — Supplement* 7, 8.

41 A series of failed Bills was introduced in 1906, 1907, 1908 and 1910. For an overview: see Mark D Janis and Jay P Kesan, 'US Plant Variety Protection: Sound and Fury …?' (2002) 39 *Houston Law Review* 727, 731–5.

42 'Patenting of Plants Promises Big Profits — and Big Problems', *Business Week* (New York), 26 August 1931, 26: 'Few plant breeders drive Hispana-Suizas [a luxury car of the 1930s]'.

43 House of Representatives Committee on Patents, *Report on Plant Patents*, HR Rep No 71-1129, 1–2 (1930); Senate Committee on Patents, *Report on Plant Patents*, S Rep No 71-315, 1–2 (1930). The reports of the congressional Committees on Patents are reproduced in 'The Plant Patent Law' (1930) 21 *Journal of Heredity* 319, 319–22, 357–61.

44 House of Representatives Committee on Patents, above n 43, 3; Senate Committee on Patents, above n 43, 2.

45 It was suggested that the only way in which the depressed nature of agriculture in the US, which only held its own by virtue of US subsidies, could be remedied was by way of 'an incentive system like the patent system': John A Dienner, 'Patents for Biological Specimens and Products' (1953) 35 *Journal of the Patent Office Society* 286, 292.

46 House of Representatives Committee on Patents, above n 43, 3; Senate Committee on Patents, above n 43, 3.

47 While the primary aim of the new law was to promote private investment in breeding, it was suggested by some that the new regime would undermine public breeding programmes, particularly the US government's free seed programme, which was administered by the US Patent Office (and

While there were still doubts about some aspects of the plant patents scheme, the proponents of the new law had garnered enough support from organisations such as the American Farm Bureau Federation, the Department of Agriculture, and from orchardists, farmers and horticulturists[48] to have identical Bills introduced into the US Senate and House of Representatives in February 1930.[49] After a brief discussion, the Bills were sent to the congressional Committees on Patents to be reviewed. In light of the Committees' recommendations,[50] revised Bills were introduced into Congress in April of 1930. After a brief debate, the *Plant Patent Act of 1930*[51] was passed by Congress on 13 May 1930, and signed by President Hoover[52] on 23 May 1930.

Based upon a practice developed in relation to design patents, applications for plant patents under the Act had to contain a single claim, which was meant to set out the distinguishing characteristics of the plant.[53] While the form of the claim varied, they tended to follow a similar pattern in which, after linking the claim to 'the plant as described', applicants would highlight the distinct features of the invention. For example, Plant Patent 1 claimed '[a] climbing rose as herein shown and described, characterised by its everblooming habit',[54] while Plant Patent 28 claimed '[t]he rose as shown and described, characterized by the golden yellow color of its petals, the form and size of its bloom, its stiff long stem, the intense fragrance, and its remontant and everblooming habit.'[55] With reference to disclosure, each claim was meant to 'describe in detail the new plant and furnish all the information possible as to how it was created so that it can be

was said to have hindered the development of the private sector seed industry in the US): see Cary Fowler, 'The *Plant Patent Act of 1930*: A Sociological History of Its Creation' (2000) 82 *Journal of the Patent and Trademark Office Society* 621, 636–7. There is a discussion of the campaign by the American Seed Trade Association against the US government's free seed programme: at 627–8.

48 House of Representatives Committee on Patents, above n 43, 4; Senate Committee on Patents, above n 43, 3. See also Congressional Record, 8750 (12 May 1930) (statement of Mr Townsend).

49 A Bill to Provide for Plant Patents, HR 11 372, 71st Congress (1930); A Bill to Provide for Plant Patents, S 4015, 71st Congress (1930).

50 The House Committee on Patents made two amendments. One added a separability clause that protected utility patents if plant patents were declared unconstitutional, the other eliminated from the scope of the Bill patents for plant varieties which were introduced to the public prior to the approval of the Act: House of Representatives Committee on Patents, above n 43, 1. The Senate Committee on Patents also added a separability clause and eliminated patents for varieties of plants which exist in an uncultivated or wild state, but are newly found by plant explorers or others: Senate Committee on Patents, above n 43, 1.

51 Pub L No 245, 46 Stat 376. For the current version: see 35 USC §§ 161–4 (2000 & Supp IV, 2005).

52 President Herbert Hoover had previous intellectual property experience. During his time as the Head of the US Department of Commerce, he had ultimate control of the US Patent Office and the US Commissioner of Patents reported to him. Hoover also led the US delegation to the October 1925 Hague Conference for the Protection of Industrial Property. See T H A, 'Herbert Hoover and the Patent Office' (June 1925) *Scientific American* 373, 373.

53 Clinton H Neagley, Donald D Jeffrey and Anthony B Diepenbrock, 'Section 101 Plant Patents — Panacea or Pitfall?' (1983) 1(2) *American Patent Law Association: Selected Legal Papers* A-1, A-10: 'each plant patent has a single claim directed to the disclosed plant. One cannot claim a genus or group of plants or any part of a plant. Thus, generic protection … is unavailable.'

54 US Plant Patent No 1 (filed 6 August 1930) (granted 18 August 1931).

55 US Plant Patent No 28 (filed 19 January 1932) (granted 4 October 1932).

definitely identified and if possible reproduced by others independently.'[56] Where colour was claimed, it was necessary for the drawings to be as accurate and permanent as possible according to a recognised standard such as Ridgway's Color Chart, A Maerz and M Rea Paul's *A Dictionary of Color*,[57] or *Specimen Tints of Winsor and Newton's Artists' Oil and Water Colours*.[58] Specifications also contained a historical account of the development of the new plant. This included information such as how the plant was bred, where the sports, buds or mutations had been found, how that plant differed from similar plants, when the plant bloomed, and the soils and climates that best suited it. While there was some uncertainty as to whether the US Patent Office allowed commercial names to be used in an application,[59] a study in 1944 showed that the majority of the patented plants contained the names given to them by their originators: a practice which has continued since.[60] Although the names were arbitrary, they were not regarded as trade marks.[61] Instead, they were used descriptively to identify particular plants.[62] Applicants also had to include an oath stating that: (1) they believed that the 'variety of plant had not been introduced to the public prior to the passage of the Act of May 23, 1930'; and (2) they had asexually reproduced the distinct and new variety of plant described in the annexed specification.[63]

The grant of a plant patent was conditional on the satisfaction of a number of criteria.[64] The main requirement was that the application should be for a 'plant variety'.[65] While there was some confusion as to the meaning of the term 'variety',[66] it was accepted that new and distinct varieties were divided into three classes: sports, mutants and hybrids. Protection did not extend, however, to

56 Robert Starr Allyn, *The First Plant Patents: A Discussion on the New Law and Patent Office Practice* (1934) 18. See also Patents, Trademarks and Copyright Rules, 37 CFR 1 §§ 1.163–4 (2007).

57 A Maerz and M Rea Paul, *A Dictionary of Color* (2nd ed, 1950).

58 Raymond A Magnuson, 'A Short Discussion on Various Aspects of Plant Patents' (1948) 30 *Journal of the Patent Office Society* 493, 504. The colour charts, such as Ridgway's Color Chart, were 'commercially manufactured set[s] of cards, much like paint-sample cards, that breeders held against a plant to identify and match a name to its colors': Daniel J Kevles, *A History of Patenting Life in the United States with Comparative Attention to Europe and Canada* (A Report to the European Group on Ethics in Science and New Technologies, 12 January 2002) 11.

59 Joseph Rossman, 'The Preparation and Prosecution of Plant Patent Applications' (1935) 17 *Journal of the Patent Office Society* 632, 639: 'The Patent Office does not object to the use of commercial names of varieties in the specification but the proposed commercial varietal name of the new plant is at present considered objectionable.'

60 Robert Starr Allyn, *Plant Patents 1934 to 1943: A Supplement to* The First Plant Patents *(Nos 1 to 84)* (1944) 40.

61 Magnuson, above n 58, 501.

62 Ibid.

63 Rossman, 'The Preparation and Prosecution of Plant Patent Applications', above n 59, 635.

64 General patent law was applicable to plant patents, except as otherwise provided — the notable exception being in relation to the description requirement in 35 USC § 112 and the number of claims. For plant patents, distinctness replaces utility and the additional requirement of asexual reproduction is introduced: *Yoder Brothers Inc v California-Florida Plant Corporation*, 537 F 2d 1347, 1377–8 (Goldberg J) (5th Cir, 1976) ('*Yoder Brothers*').

65 Allyn, *The First Plant Patents*, above n 56, 28.

66 'Variety' was used interchangeably with 'species' in the congressional Patent Committee Reports. Robert Starr Allyn suggested that there was nothing in the committee reports to suggest that 'variety' was restricted to a technical meaning and that the history of the Act indicated that the word was used in a broad sense to cover kinds, types and species: ibid 29.

tuber-propagated plants such as Irish potatoes and Jerusalem artichokes,[67] primarily because they are propagated by the same part of the plant that is used as food.[68] Another possible reason for this exclusion was that the Department of Agriculture wished to keep its own potato-breeding project outside the terms of the Act.[69] Paul Stark later said that a reason for the exclusion was that because potatoes were readily available and used both as a food source and for the growing of plants, infringement of a potato plant patent would have been 'easy' and 'widespread', thereby making enforcement absurd.[70] To qualify for patent protection, the applicant had to show that they had invented, or discovered and then asexually reproduced, the plant in question.[71] Applicants also had to show that the plant was 'novel' and 'distinct'. A plant was novel if it had not been sold or released in the US more than one year prior to the date of the application, or if the plant had not been enabled to the public (by description in a printed publication in the US more than one year before the patent application, or by release or sale of the plant more than one year prior to the patent application). A plant was distinct if it had characteristics that were clearly distinguishable from existing varieties.[72] A range of factors was used to distinguish a new plant variety, including: habit; immunity from disease; the colour of the flowers, leaves, fruit or stems; flavour; productivity; perfume; form; ease of asexual reproduction; and resistance to heat, cold or wind.[73] Reflecting the agnosticism that pervades intellectual property law, it was immaterial whether the new characteristics were inferior or superior to existing varieties or indeed, whether an entirely new species of plant had been created.[74] What mattered was simply that the new plant differed in some respect from existing plants.[75]

[67] House of Representatives Committee on Patents, above n 43, 6; Senate Committee on Patents, above n 43, 5. 'Tuber' was defined as a short, thickened portion of an underground branch (and does not cover bulbs, corms, stolons and rhizomes). A Jerusalem artichoke is a flowering plant native to North America that is used both as a vegetable and as livestock feed: Senate Committee on Patents, above n 43, 5.

[68] House of Representatives Committee on Patents, above n 43, 6; Senate Committee on Patents, above n 43, 5; Magnuson, above n 58, 467.

[69] Neagley, Jeffrey and Diepenbrock, above n 53, A-3.

[70] *Patent Law Revision Hearings Before the Subcommittee on Patents, Trademarks and Copyright of the Senate Committee on the Judiciary*, 90th Congress, pt 2, 865 (1968) (report of Paul Stark).

[71] *Bourne v Jones*, 114 F Supp 413, 413 (Whitehurst J) (SD Fla, 1951); affd 207 F 2d 173 (5th Cir, 1953); cert denied 346 US 897 (1953).

[72] Known plants were used as the basis of comparison: see House of Representatives Committee on Patents, above n 43, 5; Senate Committee on Patents, above n 43, 4–5.

[73] House of Representatives Committee on Patents, above n 43, 5; Senate Committee on Patents, above n 43, 4:

> Within any one of the above or other classes of characteristics the differences which would suffice to make the variety a distinct variety, will necessarily be differences of degree. While the degree of difference sufficient for patentability will undoubtedly be a difficult administrative question in some instances, the situation does not present greater difficulties than many that arise in the case of industrial patents.

[74] House of Representatives Committee on Patents, above n 43, 5; Senate Committee on Patents, above n 43, 4.

[75] Leonard Barron, 'Come into the Garden' (1930) 58 *Country Life* 127, 127: 'A new plant may be inferior to extant forms; but for the purposes of patenting, it is enough that it is different in such a way that its difference may be described by contrast to other recognised varieties or forms.'

Working closely with the Bureau of Plant Industry in the US Department of Agriculture, the application was examined to ensure that it complied with the relevant requirements for patentability. Once the US Patent Office was satisfied that an application was patentable, protection was granted for a term of 17 years.[76] Despite occasional attempts to broaden the scope of the right, protection was limited to unauthorised asexual reproductions (or vegetative propagations) of the patented plant.[77] This meant that plant patent protection was limited to identical reproductions or clonal copies of the patented plant. Over time, the requirement of asexual reproduction was interpreted to mean that infringement was dependent upon a plaintiff bringing evidence that the defendant's plant was derived from the patented plant.[78] For there to be an infringement, it was necessary to show that there had been a physical appropriation from the patented plant. This meant that a person could develop a similar, or even an identical, plant and not only be free from a charge of infringement but also be entitled to a patent of their own.[79] Based upon the idea that the public should be the ultimate judge of the value of the plant, the granting of a plant patent only secured a proprietary interest; it was not intended to stand as a cachet or seal of the quality of the plant. In this sense, the plant patent system differed from the registration schemes that were employed by some floral societies and advocated by bodies such as the Horticultural Council of Canada, which only registered plants that were considered to be improvements over existing forms or varieties.[80]

The basic features of this brief legislative history — the exaltation of the genius of the breeder as inventor, the claim to authorship and the evolution of the patentability criteria for new varieties — are not especially surprising. Nevertheless, the *Plant Patent Act of 1930* is still important, not least because the Act's pragmatic premises were complemented and reinforced by a number of fundamental reflections on both the basic logic of patent law and the differences between natural and human ingenuity. This process of reflection and negotiation continued for some decades in a posteriori interpretations of the Act.

76 Magnuson, above n 58, 507.

77 See *Imazio Nursery Inc v Dania Greenhouses*, 69 F 3d 1560, 1570 (Rich J) (Fed Cir, 1995).

78 See, eg, *Yoder Brothers*, 537 F 2d 1347, 1380 (Goldberg J) (5th Cir, 1976); cert denied 429 US 1094 (1977); *Kim Bros v Hagler*, 167 F Supp 665 (SD Cal, 1958); affd 276 F 2d 259 (9th Cir, 1960); *Cole Nursery Co v Youdath Perennial Gardens Inc*, 17 F Supp 159 (ND Ohio, 1936) ('*Cole Nursery*').

79 Peter Forbes Langrock, 'Plant Patents: Biological Necessities in Infringement Suits' (1959) 41 *Journal of the Patent Office Society* 787, 788–9. Langrock added the rider that it was 'theoretically possible for two plants to have identical genetic structures and yet come from different sources. Such a possibility however is almost as remote as two human beings, not twins, having identical genetic structures': at 789.

80 Barron, above n 75. Despite this, plant patents were presented as an assurance of quality, akin to a trade mark such as the 'All-American Selection' (registered as a certification mark on 23 October 1951), which was only applied to seeds that 'proved to be superior' in test trials. See also Fleeta Brownell Woodroffe, 'A Guarantee to Gardeners' (July 1945) *Better Homes and Gardens* 71: 'altho [sic] the cost of patented plants is usually somewhat higher, the extra you pay over the cost of unpatented items gets you rarity, beauty, and assured quality of stock.'

III PRODUCTS OF NATURE

Prior to 1930, it was commonly believed that irrespective of the degree of human intervention in their production, plants were products of nature and therefore not subject to patent protection.[81] The US Supreme Court observed in *Chakrabarty* that the notion that plants were outside the remit of patent law seems to have arisen from the 1889 case of *Ex parte Latimer* in which the tribunal rejected an application for a patent relating to fibre that William Latimer had found in the needle of *Pinus australis*.[82] In confirming the examiner's decision to reject the application, the US Commissioner of Patents held that the fibre that Latimer had discovered was simply a 'natural product' and, as such, could 'no more be the subject of a patent in its natural state when freed from its surroundings than wheat which has been cut by a reaper or by some new method if reaping can be patented as wheat cut by such a process.'[83]

The decision to exclude the application was made on the basis that if the claim had been allowed, the patent would have extended to 'trees of the forest and the plants of the earth, which of course would be unreasonable and impossible.'[84] Reiterating the distinction between the natural (discovery) and the artificial (invention) that underpins the 'product of nature' doctrine, the US Commissioner of Patents went on to say that while natural products such as plants were not subject to patent protection, if the products of nature had been acted upon so as to change their character, the product in its changed form would fall into the class of patentable subject matter.[85] Accordingly,

> [i]f the applicant's process had another final step by which the fibre thus withdrawn or separated from the leaf or needle in its natural state were changed, either by curling it or giving it some new quality or function which it does not possess in its natural condition as fibre, the … fibre … would … become something new or different from what it is in its natural state.[86]

When the idea of amending patent law to accommodate plant patents was mooted at the beginning of the 20th century, one of the initial responses was that the scheme was not feasible because plants fell foul of the product of nature doctrine. In the discussions that preceded the passing of the *Plant Patent Act of 1930*, the argument that plants were unpatentable products of nature was dismissed out of hand by

[81] By the 1930s, the unpatentability of products of nature was regarded as a dogma which was 'axiomatic': K P McElroy, 'Elements in Patent Law' (1929) 21 *Industrial and Engineering Chemistry* 608, 608. According to McElroy, the phrase 'product of nature' was not the result of the US Commissioner of Patent's decision in *Ex parte Latimer*, Dec Comm'r Pat 123 (1889). Rather it came from 'some law clerk with the soul of a sloganeer … [l]ikely he evolved it from his inner consciousness, as the Dutchman did his description of a giraffe': at 608.

[82] Dec Comm'r Pat 123, 123 (Commissioner Hall) (1889): patent application was for a method of extracting that fibre from the 20-inch needle of Australian pine. As the US Supreme Court noted in *Chakrabarty*, 447 US 303, 313 (Burger CJ for the Court) (1980): 'Congress … recognized that the relevant distinction was not between living and inanimate things, but between products of nature, whether living or not, and human-made inventions.'

[83] *Ex parte Latimer*, Dec Comm'r Pat 123, 127 (Commissioner Hall) (1889). See also Harold C Thorne, 'Relation of Patent Law to Natural Products' (1923) 6 *Journal of the Patent Office Society* 23, 24; Robert Cook, *Florists Exchange and Horticultural Trade World* (15 July 1933) 9.

[84] *Ex parte Latimer*, Dec Comm'r Pat 123, 126 (Commissioner Hall) (1889).

[85] Ibid.

[86] Ibid 127 (Commissioner Hall).

proponents of the legislation.[87] For example, Albert Walker, author of a leading 19th century treatise on patent law, appeared before the US House Committee on Patents in support of the 1906 Bill to Amend the Laws of the United States Relating to Patents in the Interest of the Originators of Horticultural Products[88] (which shared many features of the *Plant Patent Act of 1930*). Walker dismissed the objection that plants were not patentable because they were natural products by arguing that there was a clear distinction between ineligible discoveries (such as the discovery of the anaesthetic qualities of sulphuric ether) and eligible inventions (such as a plant 'created by' a breeder).[89] Indeed, apart from observations of the US Secretary of Agriculture at the time, who suggested that 'patent protection was limited to inventions or discoveries in the field of inanimate nature',[90] participants in the debate about the desirability of plant patents were more likely to frame their arguments in terms of some version of the products of nature doctrine than in terms of an absolute division between animate and inanimate objects.[91]

While arguments of this nature may have been sufficient to alleviate any doubts that the US Congress had about the legitimacy of plant patents, the possibility that plants were products of nature and, as such, were not patentable, resurfaced once the *Plant Patent Act of 1930* was passed. It was not clear precisely how products of nature were to be distinguished from products of human ingenuity — what mode of origination, intervention or control characterised human inventions? More precisely, how exactly did breeders have to modify or inflect natural processes in order to qualify as inventors? In part, these concerns were fuelled by the US Supreme Court decision of *American Fruit Growers Inc v Brogdex Co*,[92] which reversed the finding of the US Court of Appeals for the Third Circuit and held that an orange dipped in a solution of borax to render the skin mould-resistant was not a manufactured article and thus was not patentable. This decision, which was handed down the year after the *Plant Patent Act of 1930* was passed, reinforced the growing concern about '[w]hether varieties derived through the exercise of the plant breeders' art will not also be considered products of nature in the same sense as are products of ductile tungsten, a substance not known to occur naturally'.[93] The US Supreme Court defined the term 'manufacture' by drawing on a dictionary — 'the production of articles for use from raw or prepared materials by giving to these materials new forms, qualities, properties, or combinations, whether by handla[bor] or by machinery'.[94] The Court went on to observe that there was 'no change in the name, appearance, or general character of the fruit. It remains a fresh orange, fit

87 Robert C Cook, 'The First Plant Patent' (1931) 22 *Journal of Heredity* 313, 317–18; Robert Cook, 'Patents for New Plants' (1932) 27 *American Mercury* 66, 68.
88 HR 18 851, 59th Congress (1906).
89 Arguments Before the Committee on Patents, House of Representatives, 50th Congress, United States of America, HR 18851, Washington, 17 May 1906, 15–16. See also Janis and Kesan, above n 41, 734.
90 House of Representatives Committee on Patents, above n 43, 10; Senate Committee on Patents, above n 43, 9. Cf *Charkrabarty*, 447 US 303, 312–13 (Burger CJ for the Court) (1980).
91 McElroy, 'Elements in Patent Law', above n 81, 608.
92 283 US 1 (1931).
93 Cook, 'The First Plant Patent', above n 87, 317–18.
94 *American Fruit Growers Inc v Brogdex Co*, 283 US 1, 11 (McReynolds J for the Court) (1931).

only for the same beneficial uses as theretofore.'[95] The decision prompted some commentators to reconsider the precise nature of plant patents; in particular, it led some to ask what was characterised as one of the most important and crucial questions in determining the scope of plant patent law — namely, what does it mean to invent a plant?[96]

Proponents of the *Plant Patent Act of 1930* had consistently argued that artificial selection was a mode of invention. For example, in his observations to the congressional committee formed in February 1930 to examine the Plant Patent Bill, Thomas Edison observed that

> [n]othing that Congress could do to help farming would be of greater value and permanence than to give the plant breeder the same status as the mechanical or chemical inventors now have through patent law. There are but a few plant breeders. This … will, I feel sure, give us many [Luther] Burbanks.[97]

In this vein, and invoking the notion of origination, proponents of plant patents emphasised the time, skill and ingenuity that was needed to develop a better flavoured fruit, or a new flower with a pleasing perfume or graceful petals. For example, by highlighting the fact that over 65 000 hybrid bushes had been grown and eliminated in the development of the white blackberry, or that Luther Burbank had selected his famous seedless plum from 300 000 artificially produced variations,[98] supporters were able to show that the development of a new plant required a considerable amount of experimentation and breeding.[99] These arguments were strengthened by technological developments, notably those based on the rediscovery of Gregor Mendel's laws of heredity in 1900.[100] Burbank summed up the changes when he said that 'plant breeding has developed into a practice, and as we learn more about the underlying principles of the art, we realize that it is beginning to be fixed as a science.'[101] Anticipating the approach taken by the US Supreme Court in *Chakrabarty*, organisations such as the American Breeder's Association — which was concerned with developing Mendelian genetics, plant breeding and

[95] Ibid 12 (McReynolds J for the Court). See also *In re Ewald*, 129 F 2d 340, 342 (CCPA, 1942): a cored pear was held not to be a manufacture because it did not possess a new name, character or use; Donald Strickland, 'Recent Decisions' (1978) 47 *George Washington Law Review* 242, 245–6.

[96] Robert C Cook, 'The First Plant Patent Decision' (1937) 19 *Journal of the Patent Office Society* 187, 190.

[97] House of Representatives Committee on Patents, above n 43, 3; Senate Committee on Patents, above n 43, 3. Luther Burbank (1849–1926) was a successful and well-known breeder who developed more than 800 new varieties of plant over his 50-year career: see Peter Dreyer, *A Gardener Touched with Genius: The Life of Luther Burbank* (revised ed, 1985) xi.

[98] Joseph Rossman, 'Plant Patents' (1931) 13 *Journal of the Patent Office Society* 7, 10: 'It took Burbank 19 years to perfect the amaryllis and over 20 years to … [produce] a new hybrid lily.'

[99] R Francé, 'Experimenting with Animals and Plants: Studies in Artificial Mutation' (1909) 67 *Scientific American Supplement No 1735* 216, 216–17.

[100] Cary Fowler, 'Protecting Farmer Innovation: The Convention on Biological Diversity and the Question of Origin' (2001) 41 *Jurimetrics Journal* 477, 479. See also House of Representatives Committee on Patents, above n 43, 1; Senate Committee on Patents, above n 43, 1.

[101] Luther Burbank, 'Prodigal Mother Nature: By Cross-Breeding and Persistent Selection the Plant Breeder Speeds Up Nature's Slow, Wasteful Hit-or-Miss Methods of Producing New Species a Thousand-Fold' (1926) 134 *Scientific American* 365, 365–6. See also Henry D Hooker, 'Horticulture as a Science' (14 April 1922) 55 *Science, New Series* 384, 384–5; Randall R Howard, 'An Inventor of Roses' (1916) 25 *Illustrated World* 481.

eugenics[102] — argued that if the law was not to be outpaced by science, patent law needed to be changed to accommodate recent technological and scientific developments.[103]

Ironically, however, most of the botanical innovations that the nursery industry was so keen to protect were the product of traditional, rather than scientific, breeding practices. Although there had been a dramatic change in the science of breeding in the early part of the 20th century, the application of the new biology largely occurred outside the nursery sector. Most of the selective back-breeding used to introduce targeted traits into host varieties took place in sexually-reproduced crops such as maize.[104] In the 1920s and 1930s, there was little scientific breeding in the nursery industries. Instead, breeders relied on more traditional breeding techniques. In some cases, breeders would produce a large number of artificial hybrids, from which they would select 'a few desirable forms and destroy … great numbers of worthless individuals'.[105] In the bulk of cases, however, the industry relied on nature's own 'breeding experiments' to provide new plants — namely the seedlings, bud mutations and sports that were discovered growing on trees and plants.[106] A sport or bud variation occurs where a plant or a portion of a plant spontaneously assumes an appearance or character distinct from that which normally characterises the variety or species.[107] A mutant is a new and distinct variety that results from seedling variations generated by the self-pollination of a species.[108] Although by the 1930s, breeders had begun to subject plants to X-rays and abnormally high levels of fertilisation in an attempt to encourage the development of bud mutations and sports,[109] in most cases they relied on orchardists, farmers, landscapers and others to discover these aberrant creations.[110]

With these practices in mind, a number of articles published in the decade following the passage of the *Plant Patent Act of 1930* returned to the question of whether artificial selection was indeed a mode of invention. Many of the authors of these articles, who were mainly professional breeders (protecting their new-found status as inventors) and patent attorneys (protecting traditional patent doctrine), complained about the number of plant patents granted to individuals who had merely discovered and then asexually reproduced a new sport or mutation. The objection

[102] Fowler, 'A Sociological History', above n 47, 631.

[103] Ibid 634–5.

[104] For a general history: see Jack Ralph Kloppenburg Jr, *First the Seed: The Political Economy of Plant Biotechnology* (2nd ed, 2004).

[105] Cook, 'The First Plant Patent', above n 87, 319.

[106] D F Jones, 'Hybridization in Plant and Animal Improvement' (1922) 14 *Scientific Monthly* 5, 6–7.

[107] Rossman, 'Plant Patents', above n 98, 13.

[108] A bud mutation was defined as '[a] mutation affecting a bud, so that it gives rise to a branch (flower, etc) differing in one or more characteristics from the rest of the plant': 'A Glossary of Genetic Terms' (1937) 28 *Journal of Heredity* 71, 72.

[109] See L J Stadler, 'Some Genetic Effects of X-Rays in Plants' (1930) 21 *Journal of Heredity* 3, 3 (the experiments reported in this article were partly sponsored by a grant from the National Research Council's Committee on Effects of Radiation on Living Organisms); Raymond Pond, 'Effects of the Rays of Radium on Plants' (1909) 30 *Science* 810, 810; C Stuart Gager, 'Radium Rays and Plant Life Processes: Some Interesting Discoveries' (1909) 67 *Scientific American Supplement No 1738* 264, 264.

[110] Fowler, 'A Sociological History', above n 47, 643.

was that the breeder had 'not produced something new from the sport, but ha[d] duplicated nature's sport and claim[ed] that sport.'[111] The problem with giving protection to sports, buds and mutations was, precisely, that it did not accord with the doctrinal paradigm of invention as origination. As Robert Starr Allyn, a New York patent attorney, wrote:

> I see [no] sense in granting a patent to a [person] who claims to be a professional plant breeder and refusing a patent to an amateur plant lover who performs the same act, ie seeing and reproducing something which nature has produced without any thought on the part of the discoverer.[112]

As well as highlighting the constitutional problem in extending patent protection to mere discoveries,[113] commentators argued that

> [t]he granting of a patent to the discoverer of a form when he has taken no part in its production (bud mutation) is considered by some competent authorities to be distinctly contrary to the intent of the [*Plant Patent Act of 1930*] because of the absence of any inventive faculty in merely finding a fortuitous mutation.[114]

These concerns seemed to materialise when the 'inventor' of the first plant to be patented, Henry Bosenberg, a landscape gardener from New Jersey, admitted under oath that he had done nothing to develop the new form of climbing rose known as the 'New Dawn'. Instead, the new plant was an aberrant, repeat-flowering version of an established variety of climbing rose known as the Dr Van Fleet, which Bosenberg had bought for use in his landscape work. Bosenberg's contribution was limited to recognising and asexually reproducing the 'new' rose.[115] Commentators also drew attention to the fact that a person who merely propagated or asexually reproduced a plant that had been discovered by another could claim to be the inventor of the resulting plant.[116] This problem was highlighted by Plant Patent 11, in which two people were listed as joint inventors of a new variety of hybrid tea rose called the Ambassador.[117] According to the patent, the first inventor discovered the plant as a sport in 1929, while the second inventor fostered and developed the plant, studied it and asexually reproduced it by budding. The problem with this was that the routine propagation of a plant was seen to be even less inventive than the chance discovery of a bud or sport.[118]

111 Robert Starr Allyn, 'Plant Patent Queries' (1933) 15 *Journal of the Patent Office Society* 180, 183.

112 Robert Starr Allyn, 'More about Plant Patents' (1933) 15 *Journal of the Patent Office Society* 963, 970. Allyn had 'no objection to the grant of patents on sports, mutants or hybrids provided the inventor has done something to create the new variety': at 970.

113 House of Representatives Committee on Patents, above n 43, 7–10; Senate Committee on Patents, above n 43, 6–9. The report of the Senate Committee on Patents is reproduced in 'The Plant Patent Law' (1930) 21 *Journal of Heredity* 319, 319–22, 357–61. See also Albert Fay, 'Are Plant Patents "Inventions?"' (1937) 28 *Journal of Heredity* 261; Robert Starr Allyn, 'Plant Patent Queries: A Patent Attorney's Views on the Law' (1933) 24 *Journal of Heredity* 55, 58.

114 Robert Cook, 'Other Plant Patents' (1933) 24 *Journal of Heredity* 49, 51.

115 Cook, 'The First Plant Patent', above n 87; Orson D Munn, 'United States Plant Patent No 1' (1931) 145 *Scientific American* 303, 303.

116 Allyn, *The First Plant Patents: A Discussion on the New Law and Patent Office Practice*, above n 56, 35.

117 US Plant Patent No 11 (filed 28 February 1931) (granted 22 March 1932).

118 Cook, 'Other Plant Patents', above n 114, 50; Robert Cook, 'The Administration of the Plant Patent Law from the Breeder's Point of View' (1933) 15 *Journal of the Patent Office Society*

Most of the participants in the post-1930 debate were willing to accept that where a breeder had spent 'years of purposeful endeavour to produce the final form'[119] — as was the case where a new variety was selected from a large number of hybrid plants grown out over a series of generations — there was 'real inventiveness'[120] and, as such, the resulting product was deserving of protection.[121] It was also acknowledged that where 'definitive steps were taken such as cross-pollination of specific plants, the breeder really invents and comes within the statute'.[122] For example, breeders who induced genetic mutations by exposing plants to radiation or abnormally high levels of fertiliser were considered to be inventors, because although they may not have been sure what the results of their experiments would turn out to be, they were 'definitely experimenting and the product could hardly be called "natural"'.[123] This was the case with Plant Patent 165, which was for a pure white lily that had been developed by the General Electric Company. In developing the new plant, regal lily bulbs were exposed to a 30-minute dose of intense radiation. The resulting plant invention, which was selected from a group of plants grown from the irradiated bulbs, did not shed pollen on the white petals. The result was a lily with pure white flowers, which was highly sought after by florists. The new lily, which was described as the first 'artificial' lily to be patented, was named the Röntgen regal lily (in honour of the inventor of X-rays, Wilhelm Konrad Röntgen).[124] Although critics of the plant patent scheme were willing to accept that breeders who developed plants such as the Röntgen regal lily qualified as inventors, most new varieties resulted from the chance discovery of a bud, sport or mutation.

In October 1934, the question of what it meant to invent a plant was considered by the Northern District Court of Ohio in *Cole Nursery*,[125] the first case brought under the *Plant Patent Act of 1930*. The case concerned an action for infringement of Plant Patent 110, which had been granted over an upright variety of Japanese barberry (*Berberis thunbergii*). According to the patent specification, the breeder grew Japanese barberry seedlings over five generations, selecting out the more upright plants at each stage to use as the basis to propagate the subsequent generation.[126] In the sixth generation, the breeder obtained what he described as a perfectly

275, 276. Since the asexual reproduction of a sport does not require invention, the reproduction does not make a new plant: Allyn, 'Plant Patent Queries: A Patent Attorney's Views on the Law', above n 113, 56.

119 Cook, 'The First Plant Patent', above n 87, 316.

120 Ibid 317.

121 Ibid 318: 'While a chance bud variation may be considered to be a natural product, a variety that represents years of application and a great number of experiments with different combinations of plants represents certainly an outcome that can hardly be considered "natural" by any reasonable test.'

122 Rossman, 'The Preparation and Prosecution of Plant Patent Applications', above n 59, 643.

123 Cook, 'The First Plant Patent', above n 87, 318. At the other extreme were '[n]ew forms produced by genetic analysis, and deliberate segregation and recombination of definite genes and chromosomes' which were 'even more the products of human skill and ingenuity': Cook, 'Patents for New Plants', above n 87, 68.

124 Goldsmith, above n 40, 151; 'Keeping Pace with Science' (1935) 120(11) *The Literary Digest* 20, 20.

125 17 F Supp 159, 159 (Jones J) (ND Ohio, 1936); Cook, 'The First Plant Patent Decision', above n 96, 187.

126 *Cole Nursery*, 17 F Supp 159, 160 (Jones J) (ND Ohio, 1936).

vertical plant which formed the basis of the patented invention.[127] In discussing the validity of the patent, the Court suggested that it was not willing to accept that a plant that arose as a result of 'selecting and genetics' over five generations could be classified as an invention.[128] This was on the basis that '[t]he use of nature and knowledge of propagation of plant life [rather than human intervention] seem … to have been the forces behind the development of the upright variety of barberry.'[129] As Robert Cook noted at the time, the potential exclusion of plants developed through 'a process of select[ing] and genetics' from the remit of patentable subject matter had alarming consequences, not least because it would have endangered the validity of the vast majority of existing plant patents.[130] This was particularly the case with the large number of plant patents that had been granted in relation to 'purely sporadic occurrences [such as sports and chance seedlings] over which the plant breeder ha[d] no control'.[131]

One of the notable characteristics of these debates about the meaning of a plant invention was that they rehearsed arguments that had previously been aired in the context of utility patents, and which concerned the patentability of naturally occurring products. Discussions about the proper rationale of plant patents restated the old notion of manufacture by distinguishing between those plants which were products of nature (and which were therefore not patentable) and those which were products of human intervention (which were patentable). Arguments on all sides emphasised the role that human agency played in moulding a transcendent, pre-existing, and indisputable 'nature',[132] and this basic asymmetry was reflected in the definition of an invention as 'the adjustment of nature to human use or needs.'[133] In this context, the main question for the law was how and when the gap between nature and invention was bridged. As one observer put it, '[u]nquestionably the genetic elements which go to make up a new form of plant are "natural". Into which category of "naturalness" the courts will conclude that these phenomena of plants should be placed is an extremely interesting problem.'[134] Although the regime of plant patents could have followed this lead and circled endlessly around

[127] Ibid.

[128] Ibid.

[129] Ibid. See also at ibid: 'I am not prepared to accord invention to the result produced by such uses in respect of the upright barberry; but if it were otherwise, the fact of the knowledge and existence of the plant prior to the amendment of May, 1930, and its prior public use, would fatally impair its validity'.

[130] Cook, 'The First Plant Patent Decision', above n 96, 190. Cook estimated that between 79 and 90 per cent of the (then) existing plant patents would have been declared invalid: at 192.

[131] Ibid 190.

[132] In these accounts the 'opposition between nature and culture shadows that between the real and the constructed: nature stands for the eternal, the inexorable, the universal; culture for the variable, the malleable, the particular': Lorraine Daston, 'The Coming into Being of Scientific Objects' in Lorraine Daston (ed), *Biographies of Scientific Objects* (2000) 1, 3.

[133] See J H Simons, 'Compounds as Inventions' (1939) 21 *Journal of the Patent Office Society* 542, 542.

[134] Cook, 'The First Plant Patent', above n 87, 318. See also at 318: 'It is a little hard to distinguish the natural property of tungsten that renders it ductile under certain conditions from the natural properties of carbon and hydrogen and oxygen that permit them to combine in various ways to form a vast array of patentable chemical compounds.'

the question of how 'natural' plant inventions were,[135] it chose instead to redefine the very notion of the invention.

IV REPRODUCING NATURE

Whereas traditional utility patents were based on the assumption that the only actor able to exercise agency in relation to the development of a novel invention was the human inventor, the regime of plant patents acknowledged that nature played a key role in the creation of new plant varieties.[136] Nature provided the buds, sports and mutations that formed the basis for plant inventions. Even where breeders were engaged in scientific breeding practices such as hybridisation, selection or the genetic modification of plants through exposure to radiation or high levels of fertilisation, the results were still seen as 'fortuitous events over which the discoverer has no control.'[137] That is, the resulting biological innovations were seen to be the product of nature's own inventive efforts rather than the skill and effort of a human inventor. The role that the non-human actor played in the creation of plant inventions was reflected in the comment that 'plants are considerably different from machines, they are a direct product of little-understood mother nature, and are not merely a creation of man's mind.'[138]

Although nature played an important role in initiating the development of plant inventions, it was unable to follow through and complete the inventive process.[139] More precisely, although nature created sports, buds and mutations, it was unable to reproduce or repeat these aberrations in subsequent generations.[140] As the congressional Committee on Patents observed, 'a plant discovery resulting from cultivation is unique, isolated, and is not repeated by nature, nor can it be reproduced by nature unaided by man'.[141] While the genome of a plant variety is replicated in processes of sexual reproduction, there is no guarantee that genetic deviations appearing in a particular plant will be replicated in its progeny. So

135 For an example of the discussions about the changes needed to a crayfish for it to qualify as a manufacture: see *Ex parte Grayson*, 51 USPQ 413 (BPAI, 1941) (a shrimp with the head and digestive tract removed was not a manufacture; a thing occurring in nature, which is substantially unaltered, is not a 'manufacture').

136 Harry C Robb, 'Plant Patents' (1933) 15 *Journal of the Patent Office Society* 752, 753.

137 Cook, 'The Administration of the Plant Patent Law from the Breeder's Point of View', above n 118, 281. For a discussion of the role of bud mutations (prompted in part by the *Plant Patent Act of 1930*): see A D Shamel and C S Pomeroy, 'Bud Variations in Apples: A Study of the Role of Bud Mutation in Deciduous Fruit Improvement' (1932) 23 *Journal of Heredity* 173. Shamel and Pomeroy also discuss the impact that the *Plant Patent Act of 1930* had in fostering interest in bud variations: at 178.

138 Langrock, above n 79, 788. See also Roger A McEowen, 'Legal Issues Related to the Use and Ownership of Genetically Modified Organisms' (2004) 43 *Washburn Law Journal* 611, 628: upon passage of the Townsend-Purnell *Plant Patent Act* in 1930, Congress attempted to address these widely held beliefs 'by explaining that the work of the plant breeder "in aid of nature" should be subject to patent protection'; House of Representatives Committee on Patents, above n 43, 8; Senate Committee on Patents, above n 43, 6.

139 A bud sport was 'a gift of nature, yes, but not a gift of nature to mankind, generally': Robb, above n 136, 760.

140 House of Representatives Committee on Patents, above n 43, 5: 'They could not have been reproduced true to type by nature through seedlings'; Senate Committee on Patents, above n 43, 4. See also Rossman, 'Plant Patents', above n 98, 18.

141 House of Representatives Committee on Patents, above n 43, 7; Senate Committee on Patents, above n 43, 6. See also Rossman, 'Plant Patents', above n 98, 15.

although an infinite number of sports might appear on a tree or plant, it was highly unlikely that these would be repeated in subsequent generations, which in turn meant that the particular variety would survive for considerably less time than the patent term of 17 years.

It was at this point that the skill of the breeder was called upon to finalise the process that nature had begun but could not complete on its own. In assisting in the creation of plant inventions, the breeder was assigned two specific tasks. The first was to recognise the potential value of nature's creations. This was explicitly acknowledged in the *Plant Patent Act of 1930* which said that to be protected as a plant patent, a plant variety had to be invented or *discovered*.[142] Here, the 'art of the breeder' was to know 'what to look for, and in having the interest to look; and in skill and persistence in the making of crosses.'[143] Once a novel bud, sport or mutation had been discovered, the next task of the breeder was to asexually reproduce (or clone) the genetic aberration, which, as we have seen, was an essential condition of patentability. In this sense, the role of the breeder (and the law) was to normalise the abnormal, to stabilise and standardise nature's deviants, mutations and aberrations,[144] to 'save this freak or abnormality in plant life to make it useful to mankind'.[145] This proposition was reflected in the way that the invention was construed for the purposes of the novelty examination. In *Yoder Brothers*, it was held that

> for a plant to have 'existed' before in nature, we think that it must have been capable of reproducing itself. Thus, we have concluded that the mere fact that a sport of a plant had appeared before in the past would not be sufficient to preclude the patentability of the plant on novelty grounds, since each sport is a one-time phenomenon absent human intervention.[146]

The requirement of asexual reproduction ensured that a variety that might otherwise have been lost forever was preserved for future generations.[147] The fact that the plant invention would not have recurred in nature without the efforts of the breeder meant that the plant invention was simultaneously both natural *and* artificial. Importantly, the fact that the plant invention as reproduced by the breeder did not exist — or persist — in a natural state meant, at least for patent law purposes, that it was not a product of nature and thus potentially patentable.

In recognising the positive role that nature plays in the creation of plant inventions, plant patent law reconfigured the concept of invention. This inverted relationship between ideas and their material reproduction was reflected in a

142 *Plant Patent Act*, 35 USC § 161 (2000 & Supp IV, 2004).

143 Cook, 'The First Plant Patent', above n 87, 319. The plant originator must 'recognise the new and appreciate its possibilities': Magnuson, above n 58, 496.

144 See, eg, *Kim Bros v Hagler*, 167 F Supp 665 (SD Cal, 1958); affd 276 F 2d 259 (9th Cir, 1960).

145 Rossman, 'Plant Patents', above n 98, 13.

146 537 F 2d 1347, 1377 fn 34 (Goldberg J) (5th Cir, 1976).

147 Robb, above n 136, 753. See also House of Representatives Committee on Patents, above n 43, 5; Senate Committee on Patents, above n 43, 6; *Ex parte Moore*, 115 USPQ 145 (BPAI, 1957); Rossman, 'The Preparation and Prosecution of Plant Patent Applications', above n 59, 633. In this sense, the plant patent scheme not only provided an incentive to invest in breeding (which is the justification usually given for patent protection), but also encouraged the reproduction and preservation of genetic diversity — an issue addressed by the *Convention on Biological Diversity*, opened for signature 5 June 1992, 1760 UNTS 142 (entered into force 29 December 1993).

crucial doctrinal revision, which centred on the distinction between conception and reduction to practice. The difficulty was addressed in the decision of the US Patent Office Tribunal in *Dunn v Ragin v Carlile*.[148] The question in the case was who should be recognised as the 'inventor' of a new variety of seedless pineapple orange. Arthur A Dunn was the owner of the land upon which the parent tree had been discovered.[149] He claimed to be entitled to a patent on the bases that he had conceived the existence of the tree by observing it over the course of seven years, and that his agent had propagated cuttings from the tree.[150] Robert Lee Ragin, to whom Dunn had given permission to cut wood upon his land, identified the seedless orange tree and reproduced it through a number of generations.[151] He showed the trees to a state nursery inspector, whose evidence affirmed that by the summer of 1936, Ragin had asexually reproduced trees bearing seedless fruit.[152] Meanwhile, even on the basis of questionable evidence, Dunn could only establish that his agent had reproduced the tree in the summer of 1938.[153] This gave rise to the question of what was the proper test of inventorship under the *Plant Patent Act of 1930*, which required applicants to show that they had invented or discovered, *and* asexually reproduced the plant in question.[154]

The Tribunal started from the premise that 'an invention comprises two main inventive acts, conception and reduction to practice'.[155] Ordinarily, the latter would follow the former; but, unlike mechanical inventions, plant inventions were not the products of a prior design, so the moment of conception was 'not so readily determined'.[156] To resolve this difficulty, the Tribunal adopted the approach pioneered in relation to chemical inventions, holding that the 'conception or discovery of the new variety … must occur *concurrently* with the actual reduction to practice'.[157] Based on this revised definition, the Tribunal held that where an invention was derived by cloning a bud variation or sport, the conception of the invention 'must reside in the discovery of the new variety. A new variety may popularly be said to be conceived or discovered when an individual becomes aware of its existence.'[158] Given that bud variations could turn out to be either effects of environment or 'inherent' and reproducible traits, the nature of what was discovered or 'conceived' could only be established by reproducing the 'parent' plant: the 'ultimate proof' of conception was 'actual propagation', or reduction to practice. So in respect of the seedless pineapple orange, the invention was deemed to have been reduced to practice at the point 'when by asexual

148 50 USPQ 472 (BPAI, 1941).
149 Ibid [8].
150 Ibid.
151 Ibid [9].
152 Ibid.
153 Ibid.
154 See generally *Bourne v Jones*, 114 F Supp 413 (SD Fla, 1951); affd 207 F 2d 173 (5th Cir, 1953); cert denied 346 US 897 (1953).
155 *Dunn v Ragin v Carlile*, 50 USPQ 472 (BPAI, 1941) [2].
156 Ibid.
157 Ibid.
158 Ibid.

reproduction citrus trees would be established which bore fruits having all the attributes of the variety known as a pineapple orange with the exception of its habit of containing seeds'.[159] It followed that Ragin was the inventor because he was the first person to have reproduced the new variety asexually.[160]

In this representation of biological invention, the task of the breeder was to identify and then preserve, capture and retain what nature had spontaneously created but was unable to repeat unaided. Given this, it might be tempting to think of the role played by the breeder in plant patent law as patent law's analogue of neighbouring rights protection in copyright law, where the rationale for the grant of protection is not, as it is with most other forms of intellectual property, to encourage the creation of new cultural objects so much as to encourage third parties to bring objects that have already been created to market.[161] But this would not be an accurate reflection of plant patent law, not least because it fails to capture the important way in which the invention was reconfigured. In a sense, plant patent law saw the breeder and nature as something like joint inventors of a new variety. It was only when the skill and effort of the two were combined that a plant invention was ever able to come into existence. In this particular association of humans and nonhumans,[162] neither nature nor breeders could operate independently of each other to develop a novel plant invention.[163] Indeed, as the US Commissioner of Patents observed, the 'part played by nature and man' in the development of new plant varieties 'cannot be completely separated or weighed or credited to one or the other'.[164] By altering the concept of agency that underpins the inventive process, plant patent law fundamentally changed the way that the invention was configured. In particular, whereas mechanical inventors were inventors at the beginning, breeders were inventors after the fact. One of the consequences of this is that breeders did not create a new genetic principle — instead, they inductively appropriated a natural event. This changed the premise of invention so that it became an inductive rather than an originating act.

At the same time as it altered the notion of agency that underpinned the inventive process, plant patent law also reversed the roles normally played by the participants involved in the creation of the invention. Under traditional patent doctrine, nature provides the material which is shaped into an invention by the human inventor. In the case of plant patents, nature did the inventing, and the

159 Ibid.

160 Robert Starr Allyn, 'Patentable Yardsticks' (1943) 25 *Journal of the Patent Office Society* 791, 816.

161 This is a consequence of the way that subject matter other than works (or entrepreneurial works) is treated within copyright law: see Lionel Bently and Brad Sherman, *Intellectual Property Law* (2nd ed, 2004) 30.

162 This was particularly the case with practising lawyers. For example, Allyn (an attorney from New York) refused to accept the creative role that nature played in the development of plant inventions — 'it is difficult to see how there could be a joint invention of a plant': Allyn, *The First Plant Patents*, above n 56, 35.

163 Burbank, above n 101, 365–6. See also Rossman, 'Plant Patents', above n 98, 18: 'Nature in such instances, unaided by man, does not reproduce the new variety true to type.'

164 Rossman, 'Plant Patents', above n 98, 18.

breeder was relegated to the task of identifying and then reproducing nature's creations.

When the *Plant Patent Act of 1930* was passed, its reversal of these previously well-established roles gave rise to a concern that patentees, who were given the exclusive right to make, use and vend the invention, might have found it difficult to prove infringement. Anticipating the question which the Canadian Supreme Court found so difficult in *Schmeiser*,[165] commentators were concerned that 'the asexual reproduction of a plant might not be construed as "making" of the invention by the infringer since "nature" plays a vital part in the making of a plant'.[166] This was because the term 'make' as used in the US *Patent Act* was 'understood to mean construction by human activity whereas these plants are reproduced by growth, a person only putting the graft or scion, for example, in such a position, in the tree to be grafted upon, that it will grow.'[167] To remedy this problem, the rights given to plant patentees under the *Plant Patent Act of 1930* were extended to include the exclusive right to asexually reproduce the plant throughout the US.[168]

The decision to limit plant patent protection to asexually reproducing plants — which was reportedly taken on the advice of various agricultural scientists and was seen by many to be a temporary aberration that would be addressed as soon as other problems with the *Plant Patent Act of 1930* had been resolved[169] — meant that protection did not extend to plants that reproduced sexually by means of seeds.[170] The argument was that when a new plant was reproduced by seed, the desirable characteristics found in the parent would 'divide up among the offspring with mathematical exactness as determined in Mendel's law of heredity, and others produced by the chance union of complementary mendelizing "factors," will not reappear in the progeny.'[171] The problem, in short, was that the characteristics of a sexually reproduced plant changed from generation to generation, making patent protection difficult, if not impossible.[172] By contrast with asexually reproduced plants, sexually reproduced plants could not be seen as manufactures. Or, to put the same point the other way around, it was precisely because patent protection was limited to asexually reproduced plants that the analogy between organisms and manufactures could be sustained. This

165 [2004] 1 SCR 902.

166 Allyn, *The First Plant Patents*, above n 56, 44.

167 Memorandum from Thomas E Robertson (Commissioner of Patents) to Robert P Lamont (Secretary of Commerce), 8 March 1930, reproduced in Allyn, *The First Plant Patents*, above n 56, 70.

168 35 USC § 163 (2000 & Supp IV, 2004).

169 Cook, 'Patents for New Plants', above n 87, 66. It was intended that the *Plant Patent Act of 1930* would eventually be extended to all plants and domestic animals: at 66.

170 John G Townsend Jr, 'The Importance of Plant Patents to Agriculture: Statement by Hon John G Townsend Jr, United States Senator from Delaware' (1930) 38 *National Nurseryman: For Growers and Dealers in Nursery Stock* 5, 17. See also Langrock, above n 79, 787.

171 Rossman, 'Plant Patents', above n 98, 13; Rossman, 'The Preparation and Prosecution of Plant Patent Applications', above n 59, 633. Rossman also said that another reason why protection did not extend to sexual reproduction was because the seed (grain) was an article of commerce: see Rossman, 'Plant Patents', above n 98, 16.

172 House of Representatives Committee on Patents, above n 43, 4; Senate Committee on Patents, above n 43, 3; Langrock, above n 79, 788.

was a crucial point as it facilitated the holding in *Chakrabarty* that there was no categorical difference between organisms and manufactures.[173]

V DISCLOSING NATURE

In the *Plant Patent Act of 1930*, the difference between utility patents and plant patents was represented in the decision to limit protection to asexually reproduced plants[174] and the relaxation of the written description requirement.[175] With respect to the latter point, the question arose as to how new plant varieties were to be described and distinguished for the purposes of patent protection. Some commentators argued in favour of the introduction of 'type plants' as a part of the registration process. This would have required applicants to deposit physical copies of their plant invention which would have been preserved and maintained in dedicated farms, gardens and herbariums.[176] For example, in an open letter to the US Commissioner of Patents, Cook called for the deposit of type plants to be made a condition of patentability (similar to the discarded practice of requiring patentees to deposit a model of their mechanical inventions as a condition of grant).[177] It was believed that type plants, which would remain the actual living embodiment of what was patented, would solve some of the difficulties of the plant patent system.[178] In particular, it was thought that the type plant would provide a precise and accurate basis to determine the novelty and distinctiveness of new plants. It was also believed that an officially sanctioned physical representation of the invention would have made it easier to decide questions of infringement. However, given that the US Patent Office had long since ceased to require inventors to submit models with their patent applications, and the expense of maintaining a collection of type plants,[179] it is not surprising that these proposals were rejected. But as a result, registration became a paper-based exercise. While the US Commissioner of Patents had (and still has) the ability to require applicants to submit specimens of a patented invention,[180] this was used to supplement rather than replace the patent specification.

173 447 US 303, 303 (1980).

174 *Plant Patent Act of 1930*, Pub L No 245, § 1, 46 Stat 376. For the current version: see 35 USC § 161 (2000 & Supp IV, 2004).

175 *Plant Patent Act of 1930*, Pub L No 245, § 2, 46 Stat 376. For the current version: see 35 USC § 162 (2000 & Supp IV, 2004).

176 Cook, 'The First Plant Patent Decision', above n 96, 192.

177 Letter from Robert Cook to the Commissioner of Patents, 18 November 1932, reproduced in Cook, 'Other Plant Patents', above n 114, 50: 'In the last analysis a plant patent must refer back to an actual living plant; no drawings and descriptions can take the place of this'; Robert Cook, 'Three More Plant Patents: Plant Patents 2, 3, and 4 Issued — Patent Drawings in Color — Need for Type Plant Emphasized — Contrasts between Mechanical and Botanical Inventions' (1931) 22 *Journal of Heredity* 369, 369: 'The only hope of attaining reality in plant-variety determination is to refer back to definite type-plants.'

178 Cook, 'The First Plant Patent Decision', above n 96, 192.

179 It was said that there were between 6000 and 7500 varieties of apple alone. See generally 'Administration of Law to Patent Plants Said to Offer Many Perplexing Problems', *The United States Daily*, 18 June 1930, 4.

180 Allyn, *The First Plant Patents*, above n 56, 24: 'Sections 4890 and 4891 RS provide that the Commissioner of Patents may require specimens of ingredients for experiment — in the case of compositions — and models of devices which admit of representation'. See also Rossman, 'The Preparation and Prosecution of Plant Patent Applications', above n 59, 640: specimens of plants

In a utility patent, the specification performs two functions, which are fulfilled by the distinct elements of the claim and the disclosure. The claim defines and delimits the intangible object claimed by the inventor and distinguishes it from the prior art base — the terms of the claim define what will count as an infringement of the patent in any subsequent dispute.[181] The statutory requirement of disclosure articulates three distinct rules:

1. the written description requirement, according to which the inventor should state 'what the invention is';[182]
2. the enablement requirement, which should enable those skilled in the art to 'make and use' the invention;[183] and
3. the best mode requirement, which prescribes that the inventor should disclose the optimal known embodiment of the invention.[184]

These principles reflect the modern paradigm of invention, and more precisely, the notion that an invention consists in an idea that has a force and consistency apart from the artefacts in which it is embodied.

Although this sense of invention now seems almost self-evident, it was the outcome of a gradual process of evolution. In early modern Europe, novelty was a jurisdictional quality, both in the sense that it was relative to a particular territorial field, and in the sense that patents were granted by sovereign patrons.[185] An invention was new if it was new to the realm, and sovereigns rewarded industrial espionage as much as independent experimentation.[186] 'Originality', by contrast, was construed by reference to a universal field of technical and scientific knowledge.[187] An invention was new if it was previously undocumented in the archives of Western knowledge.[188] But the conception of inventions as ideas also presupposed a change in the mode of production of technical artefacts, from an economy of guilds to an economy of industrial manufacture in which '[a]lmost unlimited pains are … bestowed upon the original, from which a series of copies is to be produced; and the larger the number of these copies, the more care and pains can the manufacturer afford to lavish upon the original'.[189] The inventive 'idea' became the original template or design from which a succession of identical exemplars were produced, economic value being concentrated in the (patented) idea rather than its material embodiments.[190] Finally, the construction of the invention as an 'idea' presupposed the development of a patent bureaucracy in which inventions could be turned into

may be required to be sent to the US Department of Agriculture in difficult cases of novelty and distinctness of variety of the plant.

181 *University of Rochester v G D Searle & Co*, 358 F 3d 916, 920 (Lourie J) (Fed Cir, 2004).

182 Ibid 922 (Lourie J).

183 35 USC § 112.

184 *University of Rochester v G D Searle & Co*, 358 F 3d 916, 921–2 (Lourie J) (Fed Cir, 2004).

185 Biagioli, 'Patent Republic', above n 15, 1129.

186 Ibid 1142.

187 Ibid 1141.

188 Ibid 1152.

189 Charles Babbage, *On the Economy of Machinery and Manufactures* (1832) 69.

190 Biagioli, 'Patent Republic', above n 15, 1166.

textual form, and scrutinised or transmitted independently of their material embodiments. As Mario Biagioli observes, the 19th 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'.[191] Held in its textual body, the inventive idea retains the power to 'inform' the construction of material artefacts, and the statutory requirement that the invention be disclosed in writing presupposes this ability to disclose and communicate a genetic idea through textual embodiments.

The experience of interpreting and applying the *Plant Patent Act of 1930* brought with it an awareness of the difference between the functions of the specification of a utility patent and those of a plant patent. The difference was clearly made in *Application of LeGrice*, where the question before the US Court of Customs and Patent Appeals was whether the publication in England of colour pictures depicting two rose varieties barred the breeder-inventor from patenting them in the US on the basis that the photographs had placed them in the public domain.[192] The question was whether a photograph was an 'enabling description' of the varieties.[193] Starting from the premise that the *Plant Patent Act of 1930* was designed to eliminate 'discrimination … between plant inventors and industrial inventors', the Court held that a written or pictorial description did not put the public 'in possession' of the invention in the sense required by the *Patent Act of 1952*.[194] In making this decision, the Court cited[195] the observation in *Dunn v Ragin v Carlile* that

> the mere filing of an application for a patent for a new variety of plant would not enable anyone to reproduce such a plant. The plant must actually be in being and reproductions thereof must be obtainable by one of the usual forms of asexual reproduction such as grafting, budding, inarching, division or the like.[196]

In the case of manufactures, the written description (supplemented by the knowledge of the skilled artisan) could enable an artefact to be reproduced, but a written description of a plant could not have this ontogenetic capacity:

> Should a plant variety become extinct one cannot deliberately produce a duplicate even though its ancestry and the techniques of cross-pollination be known. Manufactured articles, processes, and chemical compositions when disclosed are, however, susceptible to man-made duplication.[197]

[191] Ibid 1144.
[192] 301 F 2d 929 (CCPA, 1962).
[193] Ibid 929.
[194] Ibid 933 (Smith J). The phrasing was taken from the congressional Patent Committee Reports. The Court cited the following passage from the reports: 'No one has advanced a just and logical reason why reward for service to the public should be extended to the inventor of a mechanical toy and denied to the genius whose patience, foresight, and effort have given a valuable new variety of fruit or other plant to mankind': at 932 (Smith J).
[195] Ibid 932–3 (Smith J).
[196] *Dunn v Ragin v Carlile*, 50 USPQ 472, 474 (1941).
[197] *Application of LeGrice*, 301 F 2d 929, 935 (Smith J) (CCPA, 1962).

To reproduce a plant, one needed to 'possess' the thing itself. This was recognised by an argument aired in *Application of LeGrice*, that the patent text had the secondary but essential effect of making the material form of a new variety plant available to the public:

> A plant patent performs its function by making it profitable to the developer to make as wide a distribution as possible of the res, the plant itself.… Publicity informs the public where specimens exist. This is how a plant patent adds to the store of useful knowledge.[198]

This is akin to more recent interpretations of the written description requirement in the context of biotechnological inventions,[199] which no longer see the textually-embodied idea as having ontogenetic force. In the case of deposited specimens of gene sequences, the function ascribed to the textual description is no longer that of representing an intangible scheme or concept, and communicating that scheme or concept to the 'public', but rather to signpost the location of material from which the invention can be elicited. The 'description' in question is effectively just a set of accession numbers to the public depository, or the first link in an instrumental chain that would allow a competitor to 'obtain the claimed sequences from the ATCC [American Tissue Culture Collection] depository by following the appropriate techniques to excise the nucleotide sequences from the deposited organisms containing those sequences.'[200] This was the original basis for relaxing the disclosure requirement in the case of plant patents — Congress conceded that 'intellectual possession', or the ability to provide a recipe for the fabrication of the artefact, mattered less than the physical possession of the biological 'means of production'.[201] The physical nature of the plant invention was also reflected in the fact that to prove infringement, a patentee had to show a physical taking from the patented plant.[202] In part, the reason why plant patents are unable to be separated or decoupled from the physical invention can be traced to the way that the plant inventions are generated. While originating inventions, which consist of an idea that is subsequently reduced to practice (or at least can be presented as if they followed this trajectory), are able to be translated into and out of a written form, this is not the case with plant inventions.

198 Ibid 934–5 (Smith J). The Court in *Application of LeGrice* did, however, anticipate the argument in *Chakrabarty*: 'we must be mindful of the scientific efforts which are daily adding to the store of knowledge in the fields of plant heredity and plant eugenics which one skilled in this art will be presumed to possess': at 939 (Smith J).

199 *Enzo Biochem Inc v Gen-Probe Inc*, 323 F 3d 956 (Fed Cir, 2002).

200 Ibid 966 (Lourie J).

201 House of Representatives Committee on Patents, above n 43, 7–10; Senate Committee on Patents, above n 43, 6–9.

202 *Imazio Nursery v Dania Greenhouses*, 69 F 3d 1560, 1569–70 (Rich J) (Fed Cir, 1995). See also *Application of LeGrice*, 301 F 2d 929, 935 (Smith J) (CCPA, 1962) noting 'that there are inherent differences between plants and manufactured articles', observing, in particular, that 'should a plant variety become extinct, one cannot deliberately produce a duplicate even though its ancestry and the techniques of cross-pollination be known.'

VI CONCLUSION

The decision of the US Supreme Court in *Funk Bros Seed Co v Kalo Inoculant Co* is routinely cited as authority for the epigrammatic proposition advanced by the majority that 'patents cannot issue for the discovery of the phenomena of nature … they are part of the storehouse of knowledge of all men. They are manifestations of the laws of nature, free to all men and reserved exclusively to none.'[203]

However, read as a whole, the decision reflects the complexities and indeterminacies of the notion of products of nature. In a concurring judgment, Frankfurter J observed that references to 'products of nature' or 'laws of nature' were too ambiguous to serve as exclusionary criteria of patentability:

> Everything that happens may be deemed 'the work of nature,' and any patentable composite exemplifies in its properties 'the laws of nature.' Arguments drawn from such terms for ascertaining patentability could fairly be employed to challenge almost every patent.[204]

Both dissenting judgments argued that the problem lay not in the distinction between 'discoveries' and 'inventions', but the question of description and enablement. Whereas Frankfurter J considered that organisms were not properly identifiable, Burton J (dissenting) drew on the experience of plant patents to argue that the mode of description should follow the nature of the invention:

> Machines lend themselves readily to descriptions in terms of mechanical principles and physical characteristics. … [I]t may be that a combination of strains of bacterial species, which strains are distinguished from one another and recognized in practice solely by their observed effects, can be definable reasonably only in terms of those effects.[205]

Accordingly, the question was not whether the inventor could provide an enabling description but whether they could 'identify and use the [bacterial] strains in the manner described in the patent.'[206]

In some sense, the dissenting judgments recapitulate the conceptual manoeuvre performed by the *Plant Patent Act of 1930*, which reconstituted the three cardinal elements of the modern notion of invention: origination, description and reproduction. In the logic of modern patent law, ingenuity is original — or originating — in the sense that it entirely controls the form, structure and articulation of the artefacts in which it is embodied. Thus, ingenuity can be reduced to textual form without losing any of its 'genetic' potency and it forms a design whose exemplars can be reproduced in multiple copies by means of a process of industrial manufacture.[207] In the scheme of the *Plant Patent Act of 1930* as it evolved in the years after 1930, the work of the invention was no longer that of imagining an originating or ontogenetic cause; it consisted instead in eliciting and stabilising effects whose causes could not be known and described. Thus, the central limitation

203 333 US 127, 130 (Douglas J) (1948).
204 Ibid 135.
205 Ibid 136–7.
206 Ibid 137 (Burton J).
207 See Pottage and Sherman, above n 36.

of the Act, which restricted patents to asexually-reproduced plants, became the very premise that made this new mode of invention seem like a variation on the more established paradigm of originating invention. From this perspective, one can get a better understanding of the terms that have informed the accommodation within the patent system of plant inventions and biological inventions more generally. As commentators noted at the time, the characterisation of breeders as inventors within plant patent law constituted 'a drastic revision of … *what* constitutes inventive faculty'.[208] Subsequent developments have shown that it also added new and still unresolved complications to the problems of defining this 'inventive faculty'.

[208] Robert C Cook, 'The First Plant Patent' (1932) 14 *Journal of the Patent Office Society* 398, 400 (emphasis added).