Data-driven Innovation Management

Lecture IP07 – Introduction to IP and Patents

Jacopo Staccioli, PhD[†‡]

[†] *Università Cattolica del Sacro Cuore, Milan*

[‡] *Scuola Superiore Sant'Anna, Pisa*

a.y. 2022-23

Outline

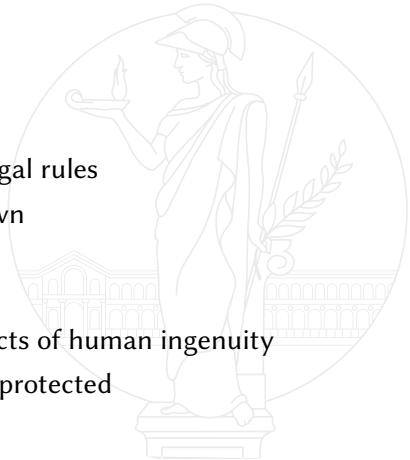
What are IP and IPRs

Intellectual Property (IP)

- products of human ingenuity
- *intangible* ideas, words, sounds, images…
- very difficult to protect in the absence of some sort of legal rules
- e.g. you can build a fence around a property land you own

Intellectual Property Rights (IPRs)

- a set of related *legal* rules intended to protect the products of human ingenuity
- intended to protect things that otherwise are not easily protected



Forms of IP protection

There are several instruments

- patents
- trademarks
- copyrights
- other regimes
  - trade secrets
  - rights of publicity
  - designs
  - …

- each has its own unique characteristics, features, laws, and principles

Outline

Philosophy of IPRs

Natural rights theory (John Locke)

- IPRs as part of a person's natural rights
- a person uses their intellectual labour to create 'something'
- they have then a natural right in the returns on their labour

Personhood theory (Margaret Jane "Peggy" Radin)

- the ability to control the fruits of a person's intellectual product is part of being a real, complete, flourishing person
- IPRs are part of personhood

Philosophy of IPRs (cont'd)

Utilitarian theory (John Stuart Mill)

- IPRs as a means to an end (*functionalism*)
- IPRs give the society as a whole an incentive

copyrights: to create more art (music, paintings, photos, novels…)
patents: to create more inventions (processes, devices, engineering breakthroughs…)
trademarks: to promote more investments in *goodwill* (reduced consumer search costs…)

Patent and Copyright Clause

"[The Federal Government has the power] *to promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writing and discoveries.*" [US Constitution: Article I, Section 8, Clause 8]

Outline

Basic economics of IPRs

- IPRs are an interference with free markets
- if we had a free market we would not have IPRs
- in principle, IPRs try to support the market

  utilitarian theory: they create (market-based) economic incentives to get people to do the things we want them to do
- the economic reward is determined by the market

- is it really true that without IPRs human ingenuity would not happen?
- are not there already powerful incentives to create/innovate?
- where's the market failure?

Basic economics of IPRs (cont'd)

- public goods
  - non-rival
  - non-excludable
- would be under-produced in the absence of intervention
- market failure

- is IP (human ingenuity) a public good?
- it is non-rival
  - if I am using an idea, you can use the same idea too
  - without diminishing each other's ability to use that idea
- it is non-excludable
  - once I tell you an idea, I cannot prevent you from not knowing, copying, or redistributing it
  - unless some law forbids you

Basic economics of IPRs (cont'd)

- IPRs allow *supra-marginal* economic returns
  - competitive market: prices approach marginal costs
  - less comp. market: prices rise above marginal costs
- with IPRs there is a *deadweight loss*[1]
- usually not as much as in a monopoly
- sometimes as much
  - e.g. in the pharmaceutical industry (Dosi et al., 2021)

[1] a measure of lost economic efficiency when the socially optimal quantity of a good or a service is not produced

Dosi, Giovanni, Luigi Marengo, Jacopo Staccioli, and Maria Enrica Virgillito (2021) *Big pharma and monopoly capitalism: A long-term view.* LEM Working Papers series n. 26/2021.
URL: https://www.lem.sssup.it/WPLem/2021-26.html

Basic economics of IPRs (cont'd)

BENEFITS

- more innovation, creativity…
- more products, commercialisation
- more investments in IP
- more disclosure

COSTS

- monopolisation costs
- rent-seeking behaviour
- restriction of future innovation and creativity
- administrative costs

The case against patents

Boldrin and Levine (2013)

"There is no empirical evidence that [patents] *serve to increase innovation and productivity, unless productivity is identified with the number of patents awarded.* [...] *In spite of the enormous increase in the number of patents and in the strength of their legal protection, the US economy has seen neither a dramatic acceleration in the rate of technological progress nor a major increase in the levels of research and development expenditure"*

Musk (2022)

"Patents are used like landmines in warfare. [...] *They don't actually help advance things; they just stop others from following you"*

Boldrin, Michele and David K. Levine (2013) 'The Case Against Patents'. *Journal of Economic Perspectives* 27(1), pp. 3–22. DOI: 10.1257/jep.27.1.3

Musk, Elon (2022) Interview by Jay Leno in *"Jay Leno's Garage"*, CNBC.
URL: https://www.cnbc.com/2022/09/21/why-elon-musk-says-patents-are-for-the-weak.html

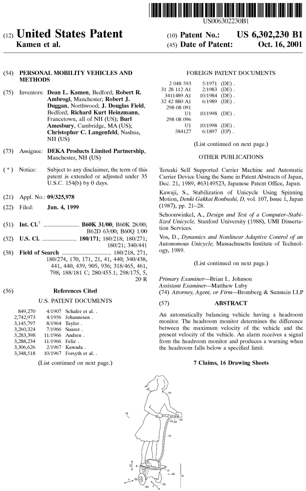
Outline

What is a patent

- a form of IPRs focussed on *inventions*
  - inventions can be almost anything
  - but there are certain standards
- among the hardest IPRs to obtain but provides the best protection
  - high cost, high benefit
- short-lived compared to other IPRs
  - ≈20 years vs. life of author + ≈70 years (copyrights) vs. potentially forever (trademarks)
- pieces of paper
  - government documents issued by a patent office (PTO)
  - e.g. every Tuesday in the US

Outline

What makes a patent document



US006302230B1

(12) **United States Patent**
Kamen et al.

(10) **Patent No.:** **US 6,302,230 B1**
(45) **Date of Patent:** **Oct. 16, 2001**

(54) **PERSONAL MOBILITY VEHICLES AND METHODS**

(75) Inventors: **Dean L. Kamen**, Bedford; **Robert R. Ambrogi**, Manchester; **Robert J. Duggan**, Northwood; **J. Douglas Field**, Bedford; **Richard Kurt Heinzmann**, Francetown, all of NH (US); **Burl Amesbury**, Cambridge, MA (US); **Christopher C. Langenfeld**, Nashua, NH (US)

(73) Assignee: **DEKA Products Limited Partnership**, Manchester, NH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/325,978**

(22) Filed: **Jun. 4, 1999**

(51) **Int. Cl.**[7] **B60K 31/00**; B60K 28/00; B62D 63/00; B60Q 1/00

(52) **U.S. Cl.** **180/171**; 180/218; 180/271; 180/21; 340/441

(58) **Field of Search** .... 180/218, 271, 180/274, 170, 171, 21, 41, 440; 340/438, 441, 440, 439, 905, 936; 318/465, 461, 798; 188/181 C; 280/455.1; 298/175, 5, 20 R

(56) **References Cited**

U.S. PATENT DOCUMENTS

849,270	4/1907	Schafer et al. .
2,742,973	4/1956	Johannesen .
3,145,797	8/1964	Taylor .
3,260,324	7/1966	Suarez .
3,283,398	11/1966	Andren .
3,288,234	11/1966	Feliz .
3,306,626	2/1967	Kawada .
3,348,518	10/1967	Forsyth et al. .

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

2 048 593	5/1971	(DE) .
31 28 112 A1	2/1983	(DE) .
3411489 A1	10/1984	(DE) .
32 42 880 A1	6/1989	(DE) .
298 08 091 U1	10/1998	(DE) .
298 08 096 U1	10/1998	(DE) .
584127	6/1897	(EP) .

(List continued on next page.)

OTHER PUBLICATIONS

Teruaki Self Supported Carrier Machine and Automatic Carrier Device Using the Same in Patent Abstracts of Japan, Dec. 21, 1989, #63149523, Japanese Patent Office, Japan.

Kawaji, S., Stabilization of Unicycle Using Spinning Motion, *Denki Gakkai Ronbushi, D,* vol. 107, Issue 1, Japan (1987), pp. 21–28.

Schoonwinkel, A., *Design and Test of a Computer–Stabilized Unicycle,* Stanford University (1988), UMI Dissertation Services.

Vos, D., *Dynamics and Nonlinear Adaptive Control of an Autonomous Unicycle,* Massachusetts Institute of Technology, 1989.

(List continued on next page.)

Primary Examiner—Brian L. Johnson
Assistant Examiner—Matthew Luby
(74) *Attorney, Agent, or Firm*—Bromberg & Sunstein LLP

(57) **ABSTRACT**

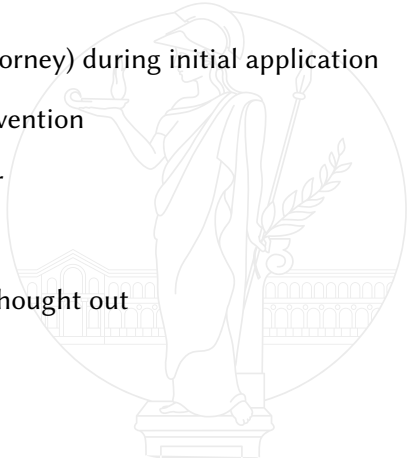
An automatically balancing vehicle having a headroom monitor. The headroom monitor determines the difference between the maximum velocity of the vehicle and the present velocity of the vehicle. An alarm receives a signal from the headroom monitor and produces a warning when the headroom falls below a specified limit.

7 Claims, 16 Drawing Sheets

- title
- serial number(s)
- relevant dates
- inventor(s) and assignee(s)
- technological classification
- references
- examiner(s), attorney(s)
- abstract
- drawing(s)
- specification
- claims

Writing style

- verbose components are provided by the inventor (or attorney) during initial application
- they are supposed to be descriptive of the underlying invention
- patents are IP documents which give *rights* to the holder
- therefore patentees choose words strategically
- every word, especially in the *claims* section is carefully thought out
- there are incentives to keep things vague



Components of a patent

Title

Personal mobility vehicles and methods

- personal mobility: what does it mean?
- anything that moves around a person, presumably
- vehicles and methods: the patent covers *both* the vehicles being invented as well as methods for using those vehicles
- the title is intended to describe both accurately and broadly what the invention covers

Components of a patent (cont'd)

Serial number(s)

patent number: US 6,302,230 B1 (AKA publication number)

filing number: 09/325,978 (AKA application number)

- uniquely identify a patent
- we will focus especially on the publication number
- *kind codes* (e.g. B1) keep track of
  - the type of a patent document (e.g. patent application, granted patent, plants, designs…)
  - the level of publication (e.g. 1st publication, 2nd publication, reissue…)

kind codes for USPTO patent publications:

https://www.uspto.gov/learning-and-resources/support-centers/electronic-business-center/kind-codes-included-uspto-patent

Components of a patent (cont'd)

Relevant dates

issue date: Oct. 16, 2001 (AKA publication date)

- determines when the patent becomes available to the public
- and therefore can be used against other possible patents as *prior art*

filing date: Jun. 4, 1999 (AKA application date)

- determines what prior art can be used to invalidate the present patent
  - e.g. to show that the present patent is in fact not *new* as of the filing date
  - kind of the flip side of the issue date

Components of a patent (cont'd)

Inventor(s)

Dean L. Kamen, Bedford; Robert R. Ambrogi, Manchester; …

- relatively rare to have a single inventor
- if someone has contributed to any part of the patent they get listed as inventors
- inventors are co-owners of the patent (prior to *assignment*)

Assignee(s)

DEKA Products Limited Partnership, Manchester, NH (US)

- patents are invented by people but their ownership is often *assigned* to a company
- in principle ownership can be assigned to other physical persons but it is rare

Components of a patent (cont'd)

Technological classification

`B60K31/00, B60K 28/00,...`

- categorise technological subject matter
- makes it easier to search for prior art to determine whether a given invention is new
- enables patents to be assigned to suitable patent *examiners*
- there exist multiple classifications with thousand of distinct codes (e.g. USPC, IPC, CPC)

Cooperative Patent Classification (CPC)

https://www.cooperativepatentclassification.org/index

Components of a patent (cont'd)

References

849,270 4/1907 *Schafer et al.*
2048 593 5/1971 (DE)
Teruaki Self Supported Carrier Machine …

- list everything the patent examiner or the applicant themselves used to show whether or not the patent is new and non-obvious in light of prior art
- references can comprise other patents (domestic or foreign) or non-patent literature (NPL)

Abstract

An automatically balancing vehicle…

- short straightforward explanation of what the patent covers
- undergoes the same strategic choice of words as for the title

Components of a patent (cont'd)

Drawings

- patents must include drawings if they are useful to determining what the invention is about
- they can picture embodiments, flowcharts…

Specification (AKA description)

The present invention pertains…

- describe the invention and relations with and improvements upon prior art
- explain the reader how to use/make the invention
- describe all drawings in sufficient detail

Components of a patent (cont'd)

Claims

What is claimed is…

- legally binding description of what the patent covers
- define the scope and boundaries of what is invented
- strategic writing but with very specific format and jargon

  "a ground-contacting module" is a broad definition of a wheel
  "a motorized drive arrangement" is a broad definition of an engine
- can be one or very many
  - patent offices charge fees for each claim
- each claim stands on its own and is independent of other claims
  - e.g. claim #1 might not meet the standard for patentability but claim #2 might
- each claim is evaluated separately when it comes to their *infringement*
  - a plaintiff only needs to show that one of the claims has been infringed to win the case

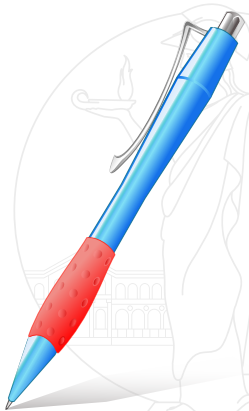
Outline

Several types of patents

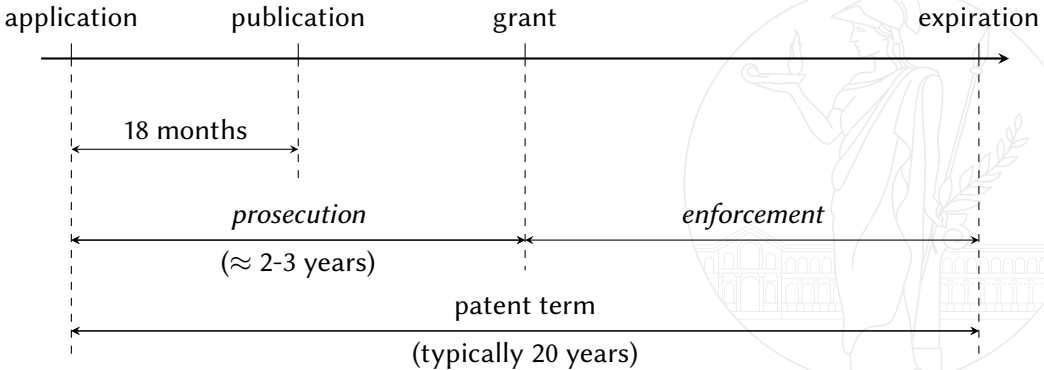
- *utility*
  - most common type of patent
  - focus of this course
  - protects *functions*, such as (parts of a) product, process…
- *utility model*
  - covers smaller inventions
  - shorter term (≈6-15 years)
  - less stringent patentability requirements
  - not available in US, UK, and Canada
- *design*
  - ≈ 10% of granted patents
  - protects the appearance of a manufactured product
  - some similarity with trademarks but different goal
- *plant*
  - < 1% of granted patents

Several types of patents (cont'd)

utility	how the pen stores ink
utility model	grip for easier holding
design	appearance of the clip



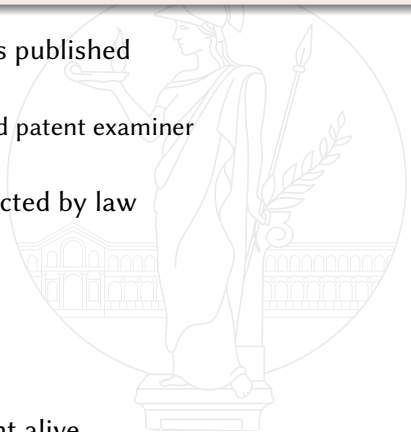
Life of a patent



Patent prosecution – key facts and figures

- it is the process by which patentability of an invention is evaluated

- secrecy for a *grace period* (18 months) then application is published
- about 2-3 years for a patent to be granted
  - back and forth process of revision between applicant and patent examiner
  - on average ≈70% of claims eventually get allowed
- when and *if* granted, IP embedded in the patent is protected by law
- filing fees are moderately low
  - a few hundred to a few thousand USD
  - depends on the number of claims
- most of the cost is for a patent attorney to assist
  - $15k to $50k is a fair budget
- maintenance fees are due after grant for keeping a patent alive



Standards for patentability

A valid patent must be

- fully and appropriately disclosed
- novel
- non-obvious
- the work of the inventors
- useful
- within the appropriate subject matter

Patentability – disclosure

"The specification shall contain a written description of the invention [...] *to enable any person skilled in the art to which it pertains* [...] *to make and use the same."* [USC 35 § 112]

- patent claims must be *enabled*
  - a (hypothetical) person having ordinary skill in the art (AKA PHOSITA) should be able to grasp how to make and use the invention
  - every field has a different instance of PHOSITA
  - the idea of PHOSITAs allows to measure how much knowledge the invention adds to the previous stock of knowledge available to society
  - it is required to disclose only what is new, not what a PHOSITA already knows
- patent claims must be *described*
  - sufficient description to show *possession* of the invention
  - possession means the inventor(s) actually invented the invention
- disclosure ensures that inventors contribute fully to the development of knowledge

Patentability – novelty

> *"A person shall be entitled to a patent unless the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention."* [USC 35 § 102]

- anything accessible before the filing date is *prior art*
  - could be patents, documents, products themselves, …
  - could be from the day before the filing date or centuries old
  - could be found locally or in a different country
- novelty ensures patents are granted only for new inventions

Patentability – non-obviousness

"A patent for a claimed invention may not be obtained [...] *if the differences between the claimed invention and the prior art are such that the claimed invention as a whole would have been obvious before the effective filing date of the claimed invention to a person having ordinary skill in the art to which the claimed invention pertains."* [USC 35 § 103]

- non-obvious means a *significant advance* over the prior art
  - significant according to the PHOSITA at the time of filing
- it is not exactly obvious what qualifies as *obvious*
  - *"the work of a simple mechanic"*
  - *"suggested by the problem to be solved"*
  - *"widely known in other fields"*
  - *"prompted by new technology"* ...
- non-obviousness ensures patents are granted only for significant inventions
  - remember that patents entail social costs...
  - regarded as the "ultimate standard" for patentability

Patentability – inventorship

> *"When an invention is made by two or more persons jointly, they shall apply for patent jointly.* [...] *If a joint inventor refuses to join in an application for patent or cannot be found or reached after diligent effort, the application may be made by the other inventor on behalf of himself and the omitted inventor."* [USC 35 § 116]

- patent inventors must be *human*
- all inventors must be listed on the patent
- an inventor is someone who has contributed *anything* to *any claim*
- inventors are by default joint owners of the patent
  - ownership can be *assigned* to other entities afterwards
- inventorship ensures the origin and ownership of inventions is clear

Patentability – utility

"Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor." [USC 35 § 101]

- all claims must be *useful*
- useful means not scientifically *implausible*
  - does the invention violates laws of physics or other inherently implausible science? (e.g. perpetual motion machines, homeopathic dilution, …)
- useful means a *specific* and *substantial use*
  - is there a use for the invention?
  - e.g. gene splicing: is there a use for a certain snippet of DNA?
- utility ensures patents are granted only for "real" and "finished" inventions

Patentability – subject matter

> *"Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor."* [ibidem]

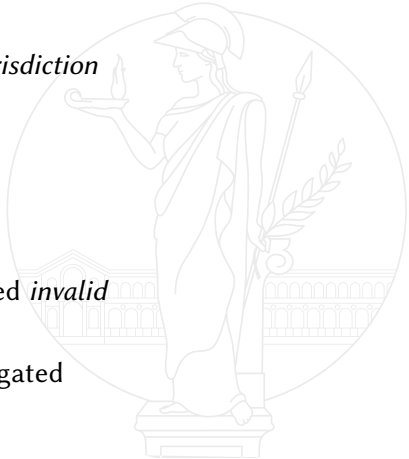
- two categories of subject matter are excluded from patenting
  1. products of nature or natural phenomena
     - but *man-made* versions can be patented (e.g. GMOs)[2]
  2. abstract ideas
     - inventions that are too *fundamental* (e.g. math equations)
- subject matter requirement restrict particular types or problematic inventions

[2] See Diamond v. Chakrabarty: https://en.wikipedia.org/wiki/Diamond_v._Chakrabarty

Outline

Patent litigation – key facts and figures

- nobody enforces the patent for the patentee
- only *granted* patents can be enforced within the PTO *jurisdiction*
- very few patents are litigated
  - typically less than 1%
- litigation is very expensive
  - ≈$6.5m per side for cases with more than $25m at stake
  - ≈$4m per side for smaller cases
- high likelihood (25-40%) that a litigated patent is declared *invalid*
  - the entire patenting process is reviewed by the court
- patentees may end up worse off than if they had not litigated
- incentives to settle cases outside court are strong



Decision to enforce a patent

PROS

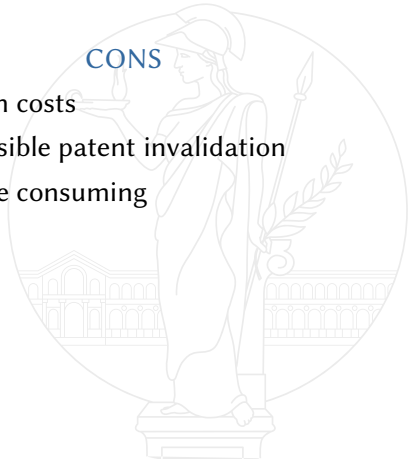
- strengthen competitive position
- force licensing revenues
- strengthen technological position

CONS

- high costs
- possible patent invalidation
- time consuming

Two approaches to enforcement

- win-at-all-cost litigation
- license at fair and reasonable price



Patent trolls

- patent trolls obtain patents to sue infringing companies
  - actually everyone obtains patents for the very same reason
- patent trolls buy patents from other companies
  - they are not the inventors or the original assignees
- patent trolls do *not* intend to utilise the underlying invention
- their sole business purpose is related to launching lawsuits
  - and often seek settlement outside court
- patent trolls are *legal* (although usually frowned upon)
  - less common in EU (loser pays all attorney fees)
  - in the US *each party* generally pays for their own (al least until 2014)[3]
- small businesses whose patents are being infringed and lack the means of launching a lawsuit may benefit from striking a deal with patent trolls

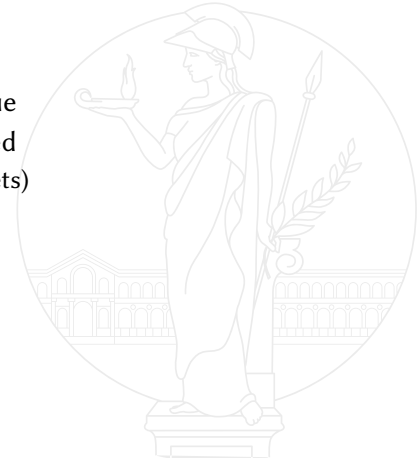
[3] https://en.wikipedia.org/wiki/Octane_Fitness,_LLC_v._ICON_Health_%26_Fitness,_Inc.

Patent value puzzle

- less than 1% of patents are litigated
- less than 5% of patents are licensed
- this suggests that most patents have negative cash value
- moreover, the distribution of patent value is very skewed
  - very few patents have very high value (like lottery tickets)
  - lotteries are *unfair* games
  - rational economic agents do not buy lottery tickets

PUZZLE: then why are patents so widespread?

- overconfidence? (my invention is the "next big thing")
- to forestall someone else's invention?
- ...?



Outline

Larami Corp. v. Amron, 1993

- Amron (defendant), a manufacturer of toy water guns, claimed that Larami Corp. (plaintiff), another manufacturer, had infringed on its patent
- infringement of a patent cannot be proven if the accused product is missing even one element of the claim

Larami Corp. v. Amron, 1993 (cont'd)

CLAIM (simplified)

1. an elongate housing having a chamber therein for liquid
2. a pump for building up pressure in said chamber for ejecting a stream of liquid therefrom substantially forward
3. means for controlling the ejection

Larami Corp. v. Amron, 1993 (cont'd)

CLAIM (simplified)

✗ an elongate housing having a chamber **therein** for liquid

✓ a pump for building up pressure in said chamber for ejecting a stream of liquid therefrom substantially forward

✓ means for controlling the ejection

OUTCOME

- no infringement
- Larami Corp. is free to manufacture and sell the Super Soaker™