Patent technology classifications for early aeronautics

Peter B. Meyer
U.S Bureau of Labor Statistics
Views and findings are those of the author, not the Bureau

ESSHC 2021 online
Session K-5 / TEC01 Patents and Innovation in 19th- and Early 20th-Century Europe
March 25, 2021

Outline

- 19th century patent classification systems
- Aeronautics/aviation of 1880-1920
- How aero was classified then vs. now
- Statistics of frequency and comparison

Underlying questions: How different were these systems substantively? How did they absorb a new field of aeronautics?

- Could draw from history of persons, patent conferences
- Measurement answers by data on classification

Patent offices classify patents

- Coded by technology, function, or industry
  - Close alternative: subject matter indexes

- Main agenda is to simplify search for prior art
  - By patent office staff, and to organize office subunits
  - Or by potential applicants and agents
  - Indirectly, to reduce or ease legal cases
  - Not mainly for research beyond these production needs

Early patent classifications

- US and Belgium: 1830 or earlier – exclusive categories
- UK: 1850s, Woodcroft's -- subject-matter index, multiple classification
- France 1853 system
- Germany 1877-78
- Austria, Norway, Denmark, Finland adopt Germany's system approximately
  - Austria: 1890s, in law (earlier system in Austria-Hungary)
  - Hungary, 1890s
- Swiss system by 1891
- Italy, 25 categories starting 1902 or earlier
- Australia, around the same time
- Netherlands 1912, possibly modeled on Germany's
- We have a little information on several others

U.S. patent classification of 1836

Class	Name
1	Agriculture
2	Metallurgy
3	Fibrous and Textiles substances
4	Chemical Processes
5	Calorifics
6	Steam and Gas Engines
7	Navigation and Maritime Implements
8	Mathematical, Philosophical, and Optical Instruments
9	Civil Engineering and Architecture
10	Land Conveyances
11	Hydraulics and Pneumatics
12	Lever, Screw, and Mechanical Power
13	Grinding Mills and Mill-Gearing
14	Lumber
15	Stone and Clay manufactures
16	Leather
17	Household Furniture
18	Arts
19	Fire Arms and Implements of War
20	Surgical and Medical Instruments
21	Wearing Apparel
22	Miscellaneous
23	Extensions, Reissues, Improvements, etc.

- 23 categories
- Note overlap: an industry category (agriculture) and tech categories for engines, fuel, chemical processes.
- Later systems organize more by narrow technical "function," and less by industry
- Later systems seem to avoid administrative classes like Class 23
- This classification is similar to the French classification of 1853.

Classifications of French patents, 1853-1904

20 categories, with one change in 1896
As in US one, agriculture, metallurgy, firearms are categories.

Category #	Title	Title in English
1	Agriculture	Agriculture
2	Hydraulique, sondage	Hydraulics, sounding
3	Machines a vapeur	Steam engines
4	Machines appliquees aux matieres textiles, tissus	Applied machinery for textile materials, fabrics
5	Machines et appareils divers, outils	Miscellaneous machinery and equipment, tools
6	Navigation	Navigation
7	Construction, batiments	Construction, buildings
8	Metallurgie	Metallurgy
9	Quincaillerie, serrurerie, coutellerie	Hardware, locksmith, cutlery
10	Carrosserie, charronnage, sellerie, bourrellerie, corderie, brosserie	Car bodywork, wheelwright, saddlery, saddlery, cordage, brushes
11	Arquebuserie	Archery and guns
12	Instruments de precision	Precision instruments
13	Substances minerales, ceramique	Mineral substances, ceramics
14	Produits chimique, aliments, conservation des substances alimentaires, cosmetiques	Chemicals, food, food preservation, cosmetics
15	Appareils d'eclairage et de chauffage, combustibles	Lighting and heating appliances, fuels
16	Habillement, chapellerie, ganterie, chaussures	Clothing, headgear, glove, shoes
17	Beaux-arts, instruments de musique	Fine arts, musical instruments
18	Papeterie	Stationery, works of paper
19	Cuirs et peaux (1853-1896)	Hides and skins (1853-1896)
	Chirurgie, medecine, hygiene (1896-1904)	Surgery, medicine, hygiene (1896-1904)
20	Articles divers	Miscellaneous items

French patent specifications show the class

RÉPUBLIQUE FRANÇAISE.

OFFICE NATIONAL DE LA PROPRIÉTÉ INDUSTRIELLE.

BREVET D'INVENTION.

VI. — Marine et navigation.
4. — Aérostation.

N° 342.188

Perfectionnements aux machines aéronautiques.

MM. Orville WRIGHT et Wilbur WRIGHT résidant aux États-Unis d'Amérique.

Demandé le 22 mars 1904.
Délivré le 1er juillet 1904. — Publié le 1er septembre 1904.
(Demande de brevet déposée aux États-Unis d'Amérique le 23 mars 1903. — Déclaration du déposant.)

Cette invention est relative à des perfectionnements aux machines aéronautiques dans

nant à l'ensemble de la machine une grande rigidité et solidité transversales. Les articula-

German system 1877-1900

- Had 89 categories, alphabetically listed
- This is an examination system, with high standards
- Class is shown on patent
- Around 1900, vast numbers of subclasses added
  - (e.g. 77h, 77h group 3)
  - Not reorganized but elaborated with detail

- Similarly for Austria, Denmark, Finland, Norway

German patent class is shown on patent specification

Otto Lilienthal MUSEUM

KAISERLICHES PATENTAMT.

PATENTSCHRIFT

— № 84417 —

KLASSE 77: SPORT.

OTTO LILIENTHAL IN BERLIN.

Flugapparat.

Zusatz zum Patente № 77916 vom 3. September 1893.

Patentirt im Deutschen Reiche vom 29. Mai 1895 ab.

Längste Dauer: 2. September 1908.

Bei dem unter Nr. 77916 geschützten Flugapparat hat sich der Uebelstand gezeigt, dafs, wenn der Apparat die Luft unter sehr spitzem Winkel durchschneidet, die Vorderkante infolge der gewölbten Flächenform Druck von oben erhalten kann. Dadurch wird ein stabiles Durchsegeln der Luft gefährdet, und der Apparat aus seiner Flugrichtung gedrängt.

Um dieses zu vermeiden, wird die vordere Flächenpartie derart beweglich gemacht, dafs dieselbe um die Vorderkante drehbar sich nach unten richten kann. Das in Fig. 1 schraffirte Flächenstück kann sich um die Achse *a b* nach unten, etwa bis in die Lage *c d* (Fig. 2) herabsenken, durch einen Luftdruck von unten aber wieder bis in die Lage *c e* erheben. Durch federnde Organe *f f* hat das schraffirte Flächenstück das Bestreben, die gesenkte Lage *c d* einzunehmen, und zwar ist der normale, auf diese bewegliche Fläche entfallende Luftdruck gerade ausreichend, um die Federn *f f* so weit zu spannen, dafs das vordere Flächenstück in die gehobene Lage *c e* gelangt und dadurch ein Theil der ganzen geschlossenen Flügelfläche wird. Hierdurch ergiebt sich die Wirkungsweise insofern, als bei einer Luftdruckverminderung unter der schraffirten Fläche *c e* die federnden Organe die Fläche selbst nach unten drücken, wodurch der verminderte Luftdruck sich wieder ergänzt und aufrichtend auf den ganzen Apparat wirkt, bis die zu einem stabilen Fluge des Apparates erforderliche Lage wieder erreicht ist.

PATENT-ANSPRUCH:

Eine Ausführungsform des durch Patent Nr. 77916 geschützten Flugapparates, bei welcher der vordere Theil der Flügelfläche um die Vorderkante *(a b)* nach unten drehbar ist und durch federnde Organe *f f* nach unten gedrückt wird, so dafs er sich beim Nachlassen des von unten wirkenden Luftdruckes nach unten dreht und dadurch ein den Apparat aufrichtendes Moment erzeugt.

Hierzu 1 Blatt Zeichnungen.

Otto Lilienthal MUSEUM

OTTO LILIENTHAL IN BERLIN.

Flugapparat.

Fig. 1.

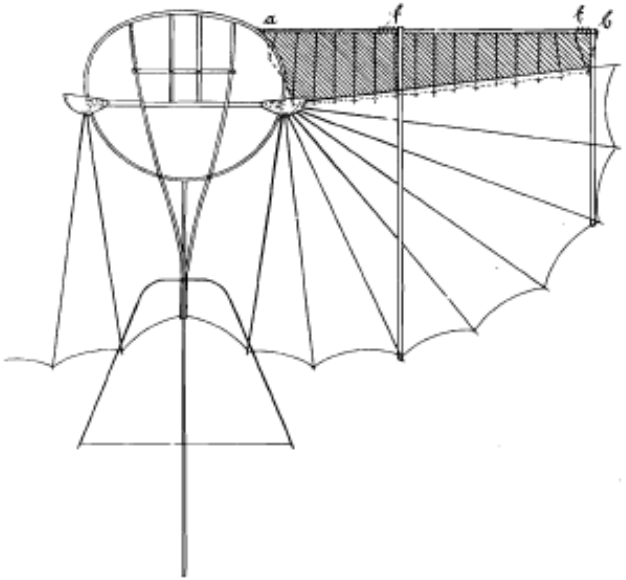


Fig. 2.

Zu der Patentschrift

№ 84417.

PHOTOGR. DRUCK DER REICHSDRUCKEREI.

British patent classifications

- The British categories were offered in publications – Abridgments, Subject-Matter Indexes – to help the public search patents
  - An agenda of creator Bennet Woodcroft
  - Whereas US classification intended for Patent Office internal use for reviewing patents and assigning work to examiners
- To aid search there were cross-listings
- The patent class was not shown on patents themselves
- Abridgements focused on aeronautics were republished, separately. (Brewer & Alexander; Neilson; Young)
- A registration system not an examination system

Classification evolution

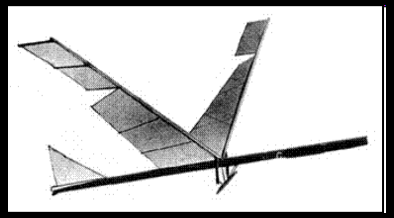
- There are more categories over time in every system
  - A function of patent numbers and/or complexity
  - US Patent Office increased categories from 22 to 158 in 1865-1880 period

- It's relatively easy to split an existing category
- Whereas it's difficult to reorganize deeply
  - it affects searching practices, and requires concensus
- Subcategories appear, adding detail, without reorganizing existing categories

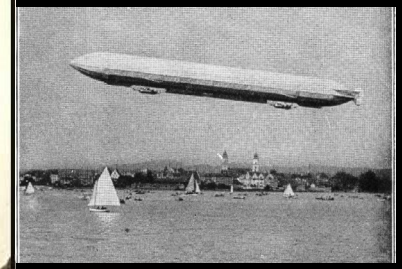
Classification activity expanded

- US Patent Office categorized for its own management
- Then was mandated to by Congress, 1836
- Patents grew greatly 1850-70
- 1898: new Classification Division in Patent Office, developing the classification itself, while examiners classify
- The system then stabilizes around 1912, evolving into the "USPC" US patent classification which lasts a century; now CPC is official.
- Based on proximate function when possible, and industry, structure, effect, or product only when needed.
- Classification Division had staff of 36 in 1923

Aeronautics

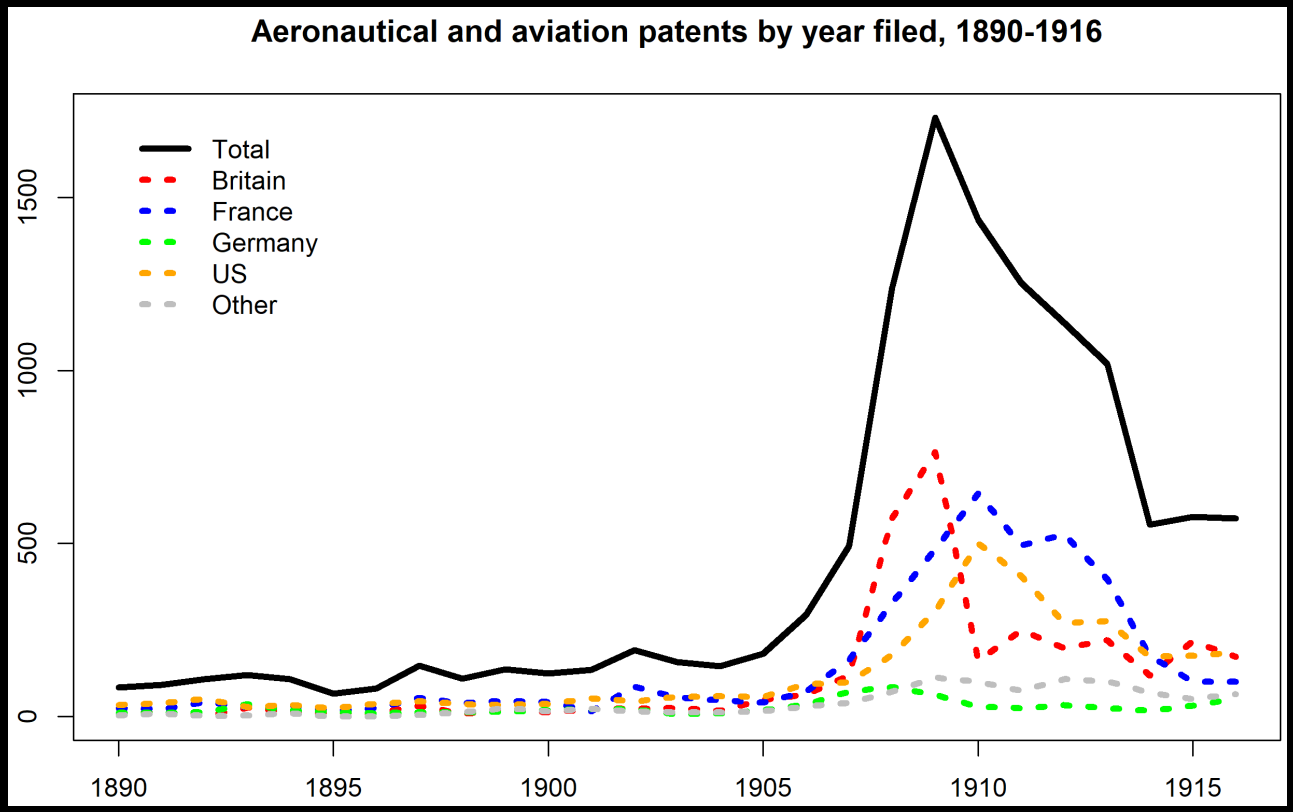


- Growing steadily from 1860s
- Sharp growth starting 1906
- Diverse, surprising ideas:
  - Flapping wings
  - Balloons/dirigibles
  - Kites, gliders
  - Helicopters, etc



Sharp growth in aero-related patents 1906-1911

We have at least some data on 15,000 aero patents up to 1920 from many searches and sources, EPO, WIPO, national patent offices, contemporary publications.
Data on patents, inventors, companies, publications, exhibitions, grows.
Patents grow when the new industry of airplane manufacturers appears.



From coded sample of all the patents, using filing-year or (grant year minus 1)

Aero category was placed differently in different systems

- French category 6, for marine navigation adds ballooning (aerostation), then aerial navigation and flying machines
- German 77 for Sport has kites, then gliders, then airplanes
- Hungarian V for "Railways and machinery" gets aircraft too, in subclass
- British category 4 is for Aeronautics starting in 1884.

- These categories lasted
  - Aviation category generally included frame, wings, propulsion, controls, etc.
  - So control systems for locomotives, boats, and aircraft are not together, rather, flying stuff was kept together

How were propellers classified?

From a sample of propeller patents

In these systems, such patents are almost categorized together:

- Belgium: all 45 in BE K
- France: 107 are FR 6.4, another 50 are FR 6.x, 8 are in some other category
- Germany: 50 are in DE 77 or 77h; 1 in another category
- Austria: 33 are in AT 77.x and 2 in other categories
- Hungary: Almost all in HU V/h

In these systems propellers seem to be split up:

- Switzerland: 7 are in CH 115, 8 in CH 129, and 1 elsewhere
- Canada: 13 in CA 244, 8 in CA 115

Is that a difference in the category system concept? Or in the inventions? Or our sample and labeling? That issue arises on small scales and large.

Patent families can give sharper evidence

- An invention could be patented in two countries
- Such "foreign filings" give data coded in two systems.

- We find these in the data based on
  (a) Patents which say they are foreign filings, or
  (b) Patent specifications with the same diagrams (a new technique?)

  By this definition we find more than the legal "family"
  Such duplicative patents were common in the boom period.

A potential metric of difference

They show us the same invention classified in two systems.

Categories may be divided based on different concepts, e.g.:

- Aerial propeller vs marine propeller
- Vertical-lift propeller vs horizontal propulsion propeller

A crosswalk summarizes a set of patents in two systems

- If the crosswalk is perfectly informative, the systems have the same classification substantively.

A statistic between 0 and 1 can show how predictive the two classifications are to one another, in a particular sample: the proportion that are mapped correctly by the crosswalk. For future work.

Conclusion

The classification systems vary in stability and detail, and in their intended usage somewhat.

The systems start aeronautics in different places

- Aeronautics/aviation wasn't split across earlier categories much
- New categories appear then split
- Offices developed categories without changing their boundaries
- It may be possible to test whether certain underlying concepts in the different classification systems are fundamentally different

- Later standards: IPC and CPC classification systems.
- We can compare to those too.