Patent classifications for aeronautics and aviation, 1880-1918

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Introduction

We have collected data on over 15,000 patents related to aeronautics and aviation filed around the world in the period from 1880 to 1918. The data are available online at http://econterms.net/aero/ and are described further in Meyer (2021a). They cover most patents in this field that were granted in that period.

The different national patent systems had substantially different technological classification systems. These classifications are designed to organize patent office work and to help search what has been patented, and which also can be useful to historical researchers. The agenda of this poster is to compare how these different classification systems adapted to the growth and change in the important concepts and designs of aeronautics, and the appearance of a commercial activity of aviation. The data gives us some cases of patents which were classified in more than one system.

National patent classification systems

Documentation of the classification systems and the practices of patent offices is spotty, and one cannot always tell how a patent was classified at the time. We have found many eclectic sources however and the research continues. We have not found a full description and analysis on the subject of 19th century patent classifications yet. We shall compare these classification systems and discuss sources in a longer draft paper, Meyer (2021b).

There were several families of patent classifications.

French and Belgian systems

Starting in 1853, the French system had about 20 major categories, and in 1904 these were divided into more than 90 smaller categories. In our period the classification assigned to a patent was clearly shown on the granted patent specification.

German, Austrian, Scandinavian, and Dutch systems

The German patent system launched in 1877-78 with 89 categories, numbered alphabetically by their titles. It becomes more elaborated and detailed over time. Class 77, Sport, was the main category for aeronautics in the 19th century. Class 77 was then subdivided and aeronautics went into 77 group h.

Nearly identical systems were adopted in Austria, Denmark, Norway, Finland, and eventually in the Netherlands, usually with some delay.

US and Canadian systems

The US had a series of patent classification systems, extending back to the 1830s. We have only partial documentation of them, but as in other countries the number of categories increased greatly over time. The long-lasting aeronautics category, number 244, appeared for the first time in 1912. Before this we do not see the categories that were applied at the time on the patent itself, although the post-1912 US patent categories, IPC, and CPC categories were applied after-the-fact by specialists. It is a multiple-classification system in which a patent can be classified in multiple categories at once. The Canadian system was similar to this U.S. one, with somewhat different numbering. Canadian patents retrieved from the CIPO system show each aero patent having a single classification, however.

The UK system

The British system of the first half of the 19th century has been used in economic historical analyses, e.g. by Nuvolari. It was revised over time. A patent specification in our period does not show which class it was assigned to. The information is only in certain reports, and we have not computerized these yet.

Other systems

Many countries had a classification systems which were not part of the above families and are not clearly related to one another. We have some information based on our patent sample about the Australian, Belgian, Cuban, Hungarian, Italian, Swedish, Swiss, and other systems. Each of these classified patents by technology, and in most cases there was one main category for aeronautics and aviation. Some countries or colonies did not evidently classify patents by technology.

Foreign filings

A foreign filing is a patent application with the same invention that has already been filed, but in another country. The inventor had an incentive to link the second patent to the first explicitly because for most of our period there was a treaty obligation for the

second country to give legal priority to the invention back to the filing date of the first patent. In most countries Patent rights were strictly within a country at the time, though these practices are more internationalized since then. In the examples before the Paris Convention of 1883, one cannot usually tell just by looking whether a patent was a foreign filing; it makes no reference to its predecessor. After 1883, it would usually be clear that a patent is a foreign filing, but the information on the number of the original patent is not always explicit. In uncertain cases, our working principle is that if the diagrams in two patents are the same, one is a foreign filing of the other, and if the diagrams are not the same, they are distinct originals. There are many cases in which we can link the two patents; other time we cannot.

The difference between first/original patents and supplementary/foreign filings is important for measuring innovation. Foreign filings look like new patents in the data but do not represent the same inventive significance. This project finds and explicitly records many such links that were not explicitly identified in the source documents.

Here is an example. In 1906, engineer Boo Henning Wallin filed for a Swedish patent on a design for a flapping wing for a flying machine. Our data on and sources for this patent is collected here: http://econterms.net/aero/Patent_SE-1907-23283.
After filing this application but before it was granted, Wallin filed for a patent on the same invention in Britain, Denmark, France, Italy, Austria, Hungary, Switzerland, and perhaps other countries. Each patent office classified patent applications in its own system. In this case we see their choices because the patent specifications are online. There are over a hundred examples of this kind, although they do not usually cover so many countries. We cannot cover all countries in this study, because some patent specifications do not show a classification or we have too few aero patents from that country.

Measure of distance between classifications

Consider the question of whether two patent systems classify patents in the same way, or along different principles. Given a data set in which two discrete classifications have been applied, we propose to measure the "distance" between the classifications by whether they classify all patents which are together in one category in one system are also together in the same category in the other system. In data science terminology, the measure is the average of the "no-information" rates when predicting from each system to the other. The result is a number in the range of 0 to 1, where 1 would mean each system is perfectly informative about how any element in the data is classified in the other.

The algorithm to compute the measure is, first, to construct a category-wise crosswalk from classification A to classification B, mapping each category in A to its most likely category in B based on the dual-coded data set. Then construct a similar crosswalk from B to A. Then compute the accuracy of each of these crosswalks as a proportion of the data set that is correctly mapped by them, and average these accuracy measures. This measure does not yet address what to do with multiple-classification systems or the bias from comparing a system with few categories to one with many.

Findings

So far the measurement suggests that the patent systems treated aeronautics and aviation similarly. In general, each country's patent system had one subcategory into which balloons, kites, fixed-wing gliders, and ornithopters (with flapping wings) would be put during our period. Patents about aero motors, instruments, or materials would go elsewhere. The Wallin patent was put in the largest aero category in each of its countries. We do not have statistical results from all the patents together yet, but there is some variation; still the proposed metric may be near 1 – little distance. Yet there was some incoherence across these systems, as the German category was Sport, mixing aeronautic devices with skis and playthings, whereas in the French system it was a category with marine navigation. (A balloon was characterized as navigating an aerial sea.) The statistical measure proposed would therefore give greater "distance" if given a broader sample. The technique may be useful for industry, occupation, and jurisdictional classification systems.

In general, the radically new technologies of aviation appear somewhere in the classification trees for each country, then split to become more elaborated over time. This is a general property of how radical innovation is represented in patent systems, as has been observed before. Aeronautics will provide a detailed example.

Acknowledgments

References
Meyer, P.B. 2021a. The great aeronautics patent spike of 1910. Working paper. Available from http://econterms.net/aero/User:Meyer

Meyer, P.B. 2021b. Patent classifications for aeronautics and aviation, 1880-1918. Working paper, long version. Available from: http://econterms.net/aero/User:Meyer