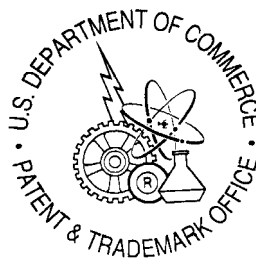


Buttons to Biotech

1996 Update Report
with supplemental data through 1998

U.S. Patenting By Women, 1977 to 1996

**The following pages are excerpted from the full *Buttons to Biotech* report.
Contact the Technology Assessment and Forecast Program
for availability and pricing of the full report.**



U.S. DEPARTMENT OF COMMERCE

PATENT AND TRADEMARK OFFICE

Office of Electronic Information Products
Technology Assessment and Forecast Program

PK3 - Suite 441, WASHINGTON, DC 20231
tel (703) 306-2600 / FAX (703) 306-2737

February, 1999

TABLE OF CONTENTS

<i>SUPPLEMENTARY COMMENTS AND DATA (THROUGH 12/1998)</i>	<i>i</i>
INTRODUCTION	1
EXECUTIVE SUMMARY	3
GENERAL BACKGROUND	4
The Patent and Trademark Office	4
The PTO Data Files	4
Types of Patents	5
U.S. PATENTING BY WOMEN	6
Historical Background	6
Methodology of the Current Study	7
Study Limited to U.S. Patents of U.S. Origin	
Name Matching	
Relative Importance of Patents	
Patenting Statistics for the Twenty Year Period, 1977-1996.....	8
By Patent Type	
By Technology	
By Ownership	
By State of Residence	
Prolific Women Inventors	
FUTURE TRENDS	15
NOTES	16
APPENDIX TABLES	
SELECTED APPENDIX TABLES FROM THE 1990 REPORT	

SUPPLEMENTARY COMMENTS AND DATA (THROUGH DECEMBER 1998)

*This supplement has been prepared in conjunction with the Patent and Trademark Office's new exhibit, **Colors of Innovation: Celebrating the Diversity of America's Creativity ... Women Inventors**, which honors Women's History Month (March 2, 1999).*

This report examines U.S. patenting by women. The original report, *Buttons to Biotech -- U.S. Patenting By Women, 1977 to 1988*, was published by the U.S. Patent and Trademark Office in January, 1990. In April of 1998, the patent data were updated through 1996 and the report was republished as *Buttons to Biotech, 1996 Update Report -- U.S. Patenting By Women, 1977 to 1996*. This most recent report is now supplemented with a limited amount of data covering the time period through December of 1998.

The supplementary data through 1998 indicate that woman inventor activity continues to increase across all areas of patenting. From 1996 to 1998, the number of U.S. origin patents * which include a woman inventor increased by 45 percent from 6,421 patents for 1996 to 9,334 patents for 1998. The woman-inventor patent share has also increased from 9.2 percent of U.S. origin patents in 1996 to 10.3 percent in 1998. Due to the methodology of this study, patents included in the study have been limited to those of U.S. origin, where origin is determined by the residence of the first-named inventor.

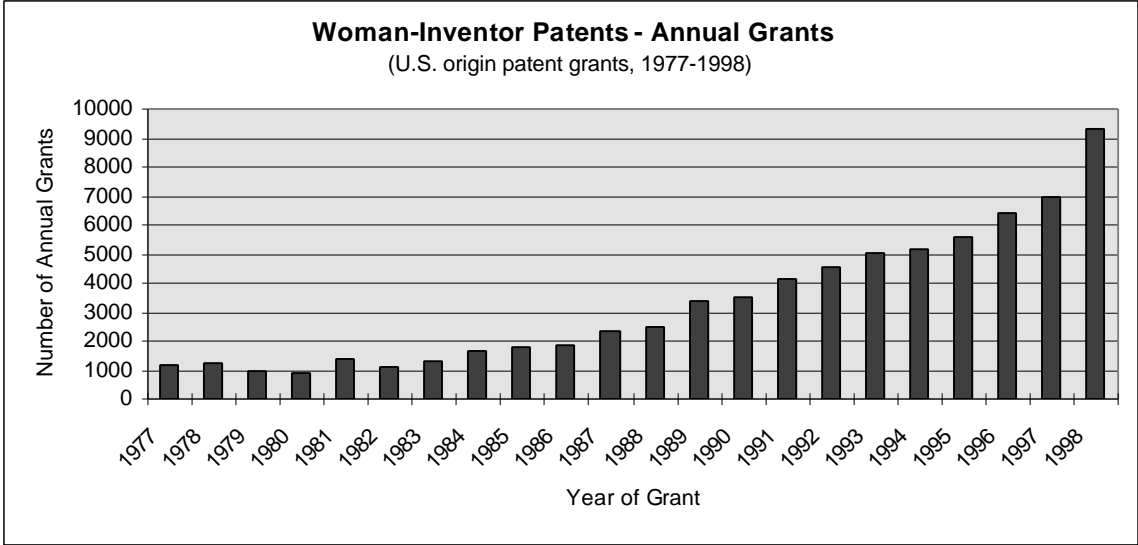
During the 1994 to 1998 period, the six organizations receiving the most U.S. origin woman-inventor patents are International Business Machines Corporation (986 patents), the U.S. Government (594 patents), Motorola Inc. (535 patents), Eastman Kodak Company (480 patents), Minnesota Mining and Manufacturing Company (473 patents), and Procter and Gamble Company (400 patents).

Woman-inventor data which have been updated through December of 1998 are included in the following tables:

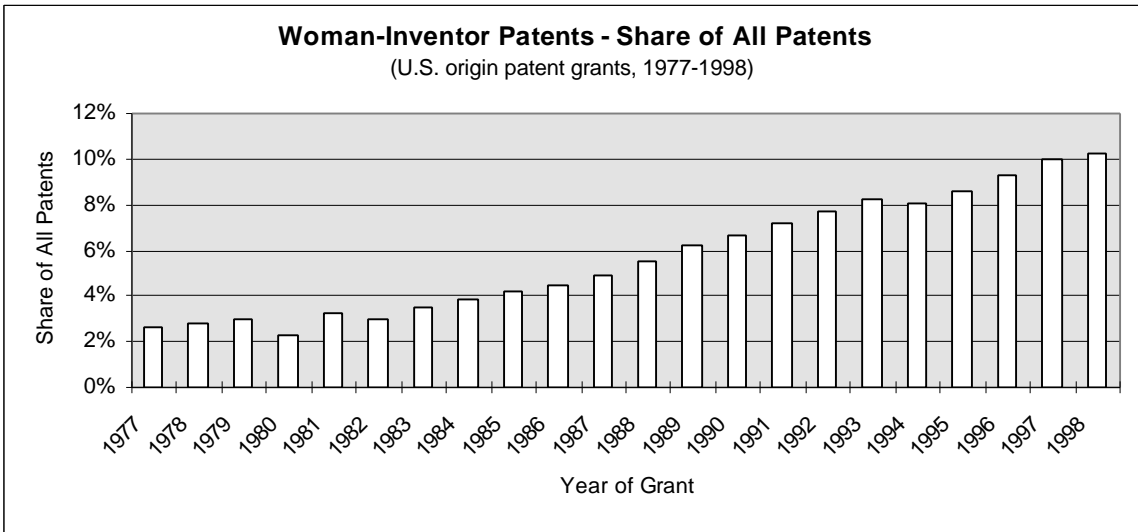
- Update to Appendix Table 1 U.S. Origin Woman-Inventor Patents: Share of Total U.S. Origin Patents, Breakdown By Patent Category, 1977 - 1998
- Update to Appendix Table 4 U.S. Origin Woman-Inventor Patents: Share of U.S. Origin Patents, Breakdown By Ownership Category, 1977 - 1998
- Update to Appendix Table 6 U.S. Origin Woman-Inventor Patents: Listing By State/Territory of Origin, Number of Patents Granted Which Have At Least One Woman Inventor, 1977 - 1998
- Listing of Organizations Receiving Woman-Inventor Patents, 1994 - 1998 Grants

Supplemental table updates through December of 1998 immediately follow. These data tables are in turn followed by the most current *Button to Biotech* report, dated April of 1998.

* Patent documents profiled in the *Buttons to Biotech* report include utility, design, plant, and reissue patents, statutory invention registrations, and defensive publications.



Update to Figure 1 Annual Grants of U.S. Origin Woman-Inventor Patents, 1977-1998
 (see Update to Appendix Table 1)



Update to Figure 2 Share of U.S. Origin Patents Which Have a Woman Inventor, 1977-1998 Grants
 (see Update to Appendix Table 2)

**UPDATE TO APPENDIX TABLE 1. U.S. ORIGIN WOMAN-INVENTOR PATENTS: SHARE OF TOTAL U.S. ORIGIN PATENTS,
BREAKDOWN BY PATENT CATEGORY *, 1977 - 1998**

Appendix table 1-1.		Percentage of patents granted within patent category which have at least one woman inventor																
Patent category	1977-82	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1977-1998
UTILITY PATENTS.....	2.5%	3.3%	3.6%	3.8%	4.1%	4.5%	5.2%	5.9%	6.2%	6.7%	7.3%	7.5%	7.6%	8.0%	8.7%	9.5%	9.8%	5.9%
DESIGN PATENTS.....	6.4%	5.7%	6.7%	7.7%	7.7%	9.4%	9.5%	9.7%	10.3%	11.6%	11.9%	13.8%	11.0%	13.1%	13.2%	13.5%	13.9%	10.6%
PLANT PATENTS.....	7.1%	5.0%	8.1%	13.3%	5.3%	4.6%	7.3%	5.5%	7.8%	10.5%	6.6%	4.2%	10.6%	10.4%	14.2%	24.3%	21.6%	9.7%
REIs, DEFs, SIRs.....	3.1%	1.7%	2.1%	2.3%	3.7%	3.3%	5.5%	5.2%	6.3%	4.0%	4.3%	6.5%	9.7%	4.7%	10.4%	8.0%	7.6%	4.7%
ALL CATEGORIES.....	2.8%	3.5%	3.9%	4.2%	4.4%	4.9%	5.5%	6.2%	6.6%	7.2%	7.7%	8.3%	8.0%	8.6%	9.2%	10.0%	10.3%	6.3%

Appendix table 1-2.		Number of patents granted within patent category which have at least one woman inventor																
Patent category	1977-82	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1977-1998
UTILITY PATENTS.....	5,526	1,081	1,389	1,516	1,572	1,962	2,094	2,974	2,958	3,426	3,802	4,002	4,257	4,435	5,330	5,860	7,881	60,065
DESIGN PATENTS.....	1,203	187	231	267	273	367	347	376	520	705	718	1,024	845	1,083	1,037	1,047	1,381	11,611
PLANT PATENTS.....	53	7	13	19	8	6	19	19	12	25	13	10	30	21	26	56	53	390
REIs, DEFs, SIRs.....	56	5	5	5	13	12	18	18	23	12	14	22	29	15	28	19	19	313
ALL CATEGORIES.....	6,838	1,280	1,638	1,807	1,866	2,347	2,478	3,387	3,513	4,168	4,547	5,058	5,161	5,554	6,421	6,982	9,334	72,379

Appendix table 1-3.		Number of patents granted within patent category regardless of inventor																
Patent category	1977-82	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1977-1998
UTILITY PATENTS.....	223,293	32,871	38,367	39,555	38,126	43,520	40,496	50,186	47,390	51,179	52,253	53,231	56,066	55,739	61,104	61,707	80,295	1,025,378
DESIGN PATENTS.....	18,657	3,278	3,428	3,475	3,546	3,902	3,645	3,883	5,069	6,075	6,013	7,416	7,697	8,251	7,863	7,747	9,914	109,859
PLANT PATENTS.....	744	140	161	143	150	131	260	345	153	237	196	236	283	201	183	230	245	4,038
REIs, DEFs, SIRs.....	1,813	301	239	221	355	363	327	346	364	299	329	338	299	319	269	238	251	6,671
ALL CATEGORIES.....	244,507	36,590	42,195	43,394	42,177	47,916	44,728	54,760	52,976	57,790	58,791	61,221	64,345	64,510	69,419	69,922	90,705	1,145,946

* Patent origin is determined by the residence of the first-named inventor. U.S. origin patents are those patents whose first-named inventor resided in the United States at the time of patent grant.

Woman-inventor patents have been identified by matching first and middle inventor names against a list of known female names.

NOTE: The Technology Assessment and Forecast database, which was relied upon to generate this report, is continually updated to correct data errors and incorporate new data. Therefore, patent counts presented in this update may differ slightly from the counts presented in earlier reports.

**UPDATE TO APPENDIX TABLE 4. U.S. ORIGIN WOMAN-INVENTOR PATENTS: SHARE OF U.S. ORIGIN PATENTS,
BREAKDOWN BY OWNERSHIP CATEGORY *, 1977 - 1998**

Appendix table 4-1.		Percentage of patents granted within ownership category which have at least one woman inventor																
Ownership category	1977-82	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1977-1998
CORPORATE OWNED.....	2.1%	3.0%	3.5%	3.6%	3.9%	4.4%	5.2%	5.9%	6.1%	6.8%	7.5%	8.0%	7.8%	8.3%	9.1%	9.9%	10.1%	6.0%
U.S. GOVERNMENT OWNED....	2.4%	3.4%	4.2%	4.5%	4.5%	5.3%	6.8%	7.6%	8.4%	7.7%	8.3%	7.3%	9.9%	9.9%	11.2%	13.6%	11.8%	6.2%
INDIVIDUAL OWNED.....	4.7%	4.8%	5.1%	5.6%	5.7%	6.3%	6.4%	6.8%	7.9%	8.3%	8.4%	9.2%	8.4%	9.3%	9.7%	9.9%	10.8%	7.3%
ALL CATEGORIES.....	2.8%	3.5%	3.9%	4.2%	4.4%	4.9%	5.5%	6.2%	6.6%	7.2%	7.7%	8.3%	8.0%	8.6%	9.2%	10.0%	10.3%	6.3%

Appendix table 4-2.		Number of patents granted within ownership category which have at least one woman inventor																
Ownership category	1977-82	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1977-1998
CORPORATE OWNED.....	3,490	796	1,051	1,143	1,175	1,489	1,657	2,301	2,232	2,723	3,135	3,495	3,638	3,876	4,628	5,239	6,976	49,044
U.S. GOVERNMENT OWNED....	170	35	52	51	51	60	57	74	89	98	101	90	129	107	107	131	120	1,522
INDIVIDUAL OWNED.....	3,178	449	535	613	640	798	764	1,012	1,192	1,347	1,311	1,473	1,394	1,571	1,686	1,612	2,238	21,813
ALL CATEGORIES.....	6,838	1,280	1,638	1,807	1,866	2,347	2,478	3,387	3,513	4,168	4,547	5,058	5,161	5,554	6,421	6,982	9,334	72,379

Appendix table 4-3.		Number of patents granted within ownership category regardless of inventor																
Ownership category	1977-82	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1977-1998
CORPORATE OWNED.....	170,171	26,265	30,388	31,399	29,895	34,096	32,000	38,853	36,842	40,297	41,931	43,899	46,535	46,628	51,058	52,680	68,936	821,873
U.S. GOVERNMENT OWNED....	7,066	1,042	1,227	1,126	1,132	1,130	841	968	1,059	1,268	1,218	1,225	1,299	1,076	955	962	1,021	24,615
INDIVIDUAL OWNED.....	67,269	9,283	10,580	10,868	11,150	12,690	11,887	14,939	15,075	16,225	15,642	16,097	16,511	16,806	17,406	16,280	20,748	299,456
ALL CATEGORIES.....	244,506	36,590	42,195	43,393	42,177	47,916	44,728	54,760	52,976	57,790	58,791	61,221	64,345	64,510	69,419	69,922	90,705	1,145,944

* The above ownership categories are not identical to the categories listed in the 1990 *Buttons to Biotech* report. See the explanatory note on the introductory page to the 1990 Appendix Tables.

Included in this table are utility, design, plant, and reissue patents, defensive publications, and statutory invention registrations. U.S. origin patents are those patents whose first-named inventor resided in the United States at the time of patent grant.

Woman-inventor patents have been identified by matching first and middle inventor names against a list of known female names.

NOTE: The Technology Assessment and Forecast database, which was relied upon to generate this report, is continually updated to correct data errors and incorporate new data. Therefore, patent counts presented in this update may differ slightly from the counts presented in earlier reports.

INTRODUCTION

This report examines U.S. patenting by women. It updates the original report, *Buttons to Biotech -- U.S. Patenting By Women, 1977 to 1988*¹, published by the U.S. Patent and Trademark Office in January, 1990. This report is similar to the 1990 report but includes data through 1996. Some additional data tables have also been included in this update (see the Appendix).

EXECUTIVE SUMMARY

Buttons to Biotech - U.S. Patenting By Women, 1977 to 1996 has been prepared by the United States Patent and Trademark Office, Technology Assessment and Forecast Program, as an update to the original report, *Buttons to Biotech - U.S. Patenting By Women, 1977 to 1988*, which was published in 1990 as part of the bicentennial celebration of the signing of the original Patent Act in 1790.

This report presents a brief history of women inventors in the United States and examines trends in U.S. patenting by women in the 1977 to 1996 period. It focuses exclusively on patents of U.S. origin (i.e., patents for which the first-named inventor resided in the United States at the time of grant) and attempts to identify which of those U.S. origin patents include a woman inventor. Year, technology, ownership, and state of origin profiles of U.S. origin woman-inventor patents are presented based on patent data extracted from the U.S. Patent and Trademark Office's Technology Assessment and Forecast data base.

Highlights of the report follow:

- * Of the 985,319 U.S. origin patents granted during the 1977 to 1996 period, 5.7 percent included a woman inventor, i.e., were woman-inventor patents.
- * The woman-inventor patent share of annually granted U.S. origin patents rose from 2.6 percent in 1977 to 9.2 percent in 1996, a more than tripling of the share of woman-inventor patents during the period.
- * In 1996, 15.7 percent of the U.S. origin patent grants in chemical technologies included a woman inventor; 1996 woman-inventor patent shares for U.S. origin patent grants in mechanical and electrical technologies were 6.2 percent and 6.0 percent, respectively.
- * In 1996, 11.2 percent of the U.S. origin patent grants which were owned by the Federal Government at the time of grant included a woman inventor; corresponding 1996 woman-inventor shares for patent grants which were owned by non-Federal organizations (primarily corporations) and by individuals were 9.1 percent and 9.7 percent, respectively.
- * During the 1977 to 1996 period, most of the U.S. origin patent grants to women, 82.6 percent, were for utility patents, i.e., inventions, as compared to 16.4 percent which were for aesthetic design patents and 0.5 percent which were for plant patents.
- * Women inventors showed the greatest participation in design and plant patenting within the group of U.S. origin patents studied for the twenty year period. About 10.0 percent of the U.S. origin design patent grants and 7.9 percent of the U.S. origin plant patent grants included a woman inventor while a lesser but growing 5.2 percent of the U.S. origin utility patent grants included a woman inventor.
- * For the 1977 to 1996 period, the largest share of the U.S. origin woman-inventor utility patent grants, 49.5 percent, pertained to chemical technologies, while 36.2 percent pertained to mechanical technologies and only 14.3 percent pertained to electrical technologies.
- * Among the U.S. origin utility patents granted during the 1977 to 1996 period, women inventors showed the greatest participation within chemical technologies. For the period, about 9.0 percent of the patent grants pertaining to chemical technologies included a woman inventor while only 3.9 percent and 3.4 percent, respectively, of the patent grants pertaining to mechanical and electrical technologies included a woman inventor. Woman-inventor participation within chemical technologies is particularly evident in the biotechnology and pharmaceutical areas.
- * About 35 percent of the U.S. origin woman-inventor patents granted during the 1977 to 1996 period originated from California, New York, or New Jersey.

GENERAL BACKGROUND

The Patent And Trademark Office

The power of the United States Congress to enact laws relating to patents originates from Article I, Section 8 of the Constitution, which reads "Congress shall have 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 writings and discoveries." Under this power, the first Patent Act was signed into law by George Washington on April 10, 1790. Congress has since enacted various laws relating to patents. The current law is a general revision which was enacted on July 19, 1952, and which came into effect on January 1, 1953. It is codified in Title 35, United States Code. The patent law specifies the subject matter for which a patent may be obtained and the conditions for patentability. The law establishes the Patent and Trademark Office for administering the law relating to the granting of patents and contains various other provisions relating to patents.

In the two centuries since the signing of the first Patent Act, the patent system has played a vital role in fostering and rewarding human innovation. As it looks toward its third century of operation, the Patent and Trademark Office is actively pursuing plans to ensure the successful continuation of its mission as a promoter of the progress of science and the useful arts.

The PTO Data Files

The U.S. Patent and Trademark Office (PTO) maintains a large and continually expanding file of U.S. and foreign patents and technical literature. As of December 1997, this file included approximately 6.1 million distinct U.S. patents. These documents are classified into about 430 broad technological categories called classes and more than 140,000 narrower technological categories called subclasses which together make up the U.S. Patent Classification System.

Each patent is classified in a primary or "original" subclass based on the subject matter of the patent's claims. Copies of the patent are placed as references in additional subclasses of this file when the patent contains significant technology pertinent to those subclasses. With such multiple placement or "cross-referencing," the patent file has grown to contain over 19 million U.S. patents. Including similarly categorized foreign patents and other technical publications, the PTO houses a collection which totals more than 36 million documents with over half a million documents being added every year.

In order to facilitate the use of the patent file, the PTO established the Technology Assessment and Forecast (TAF) Program in 1971. In its most general terms, the mission of the program is to stimulate the use and enhance the usability of the patent file, and to assemble, analyze, and make available meaningful data about the file. To achieve this mission, the PTO established the TAF computer data base of U.S. patents. This report has been prepared based on the analysis of information extracted from the TAF data base.

Types of Patents

The PTO issues several different types of patent documents offering different kinds of protection and covering different types of inventions. For purposes of simplicity, unless otherwise specified, the word "patent," as used throughout this report refers to all types of patent documents issued by the PTO.

A recently issued PTO patent document is one of six types, generally described below. See *U.S. Code Title 35 - Patents* for a full description of patents and patent laws.

- * Utility Patent- Issued for the invention of a new and useful process, machine, manufacture, or composition of matter, or a new and useful improvement thereof, it generally permits its owner to exclude others from making, using, or selling the invention for a period of up to twenty years from the date of patent application filing ++, subject to the payment of maintenance fees. Approximately 90 percent of the patent documents issued by the PTO in recent years have been utility patents, also referred to as "patents for invention."
- * Design Patent- Issued for a new, original, and ornamental design for an article of manufacture, it permits its owner to exclude others from making, using, or selling the design for a period of fourteen years from the date of patent grant. Design patents are not subject to the payment of maintenance fees.
- * Plant Patent- Issued for a new and distinct, invented or discovered asexually reproduced plant including cultivated sports, mutants, hybrids, and newly found seedlings, other than a tuber propagated plant or a plant found in an uncultivated state, it permits its owner to exclude others from making, using, or selling the plant for a period of up to twenty years from the date of patent application filing ++. Plant patents are not subject to the payment of maintenance fees.
- * Reissue Patent (REI)- Issued to correct an error in an already issued utility, design, or plant patent, it does not affect the period of protection offered by the original patent.
- * Defensive Publication (DEF)- Issued instead of a regular utility, design, or plant patent, it offers limited protection, defensive in nature, to prevent others from patenting an invention, design, or plant. The DEF was replaced by the Statutory Invention Registration in 1985-86.
- * Statutory Invention Registration (SIR)- This document replaced the Defensive Publication in 1985-86 and offers similar protection.

++ Although, the length of utility and plant patent protection (patent term) was previously seventeen years from the date of patent grant, utility and plant patents filed after June 8, 1995, now have a patent term of up to twenty years from the date of filing of the earliest related patent application. Utility and plant patents which were applied for prior to June 8, 1995, and which were or will be in force after June 8, 1995, now have a patent term of seventeen years from the date of patent grant or twenty years from the date of filing of the earliest related patent application, whichever is longer. Utility patents are subject to the payment of periodic maintenance fees to keep the patent in force. Patent terms can be extended under some specific circumstances. See the *U.S. Code Title 35 - Patents* for a full description of patent laws.

U.S. PATENTING BY WOMEN

Historical Background

In the late 1800's, the Patent Office published a list of U.S. patents granted to women from 1790 to 1895. The list, a result of the efforts of Charlotte Smith, president of the National Industrial League of America,² includes the patent number, woman's name, title of the invention, and date of grant.³ According to this list, no U.S. patents were granted to women until May 5, 1809, when Mary Kies received a patent titled "Straw weaving with silk or thread." In 1900, the Commissioner's Report stated, "From 1790 to March 1, 1895, some 5,535 patents were granted to women." This represents about one out of every 100 patents granted during the period.⁴

The listing of patents granted from October 1, 1892 to March 1, 1895, includes, in addition, a breakdown of issued utility patents by the Patent Office classes which were used to categorize the technology at that time (Table 1). The areas of *Culinary Utensils* and *Wearing Apparel* showed the most patents granted to women during that period. The areas *Furniture And Furnishings* and *Washing And Cleaning* showed somewhat lesser but still substantial activity by women inventors.

Table 1

Number of Utility Patents issued to Women in the period October 1, 1892 to March 1, 1895			
Distributed according to Patent Office classes			
Class	Number	Class	Number
Agricultural Implements	15	Motors	3
Art Appliances	9	Musical Apparatus	6
Baby Carriers	6	Plumbing	3
Barrel Attachments	4	Preserving and Disinfecting	2
Bicycle Attachments	2	Printing and Binding	5
Building Appurtenances	22	Railway Appliances	8
Bottling Apparatus	2	Screens and Awnings	6
Boxes and Baskets	6	Sewing and Spinning	30
Clocks and Repairing	3	Stationery	9
Culinary Utensils	102	Theatrical Apparatus	4
Educational Appliances	15	Toilet Articles	11
Flowers and Plants	5	Toys and Games	27
Furniture and Furnishings	55	Trunks and Bags	18
Heating Apparatus	31	Typewriters and Appliances	6
Horseshoes	3	Washing and Cleaning	52
Medical Appliances	23	Wearing Apparel	132
		Miscellaneous	27

SOURCE: *Women Inventors to Whom Patents Have Been Granted By the United States Government, October 1, 1892 to March 1, 1895, Appendix No. 2*, Compiled under the direction of the Commissioner of Patents (Washington, D.C.: Government Printing Office, 1895)

A later U.S. Government study of ten selected years between 1905 and 1921 estimated that during that period women received 1.4 percent of all U.S. patents granted.⁵ The purposes served most frequently by those woman-inventor patents included *Household* and *Personal Wear And Use* (Table 2). In a more recent statistical study, it was estimated that about 1.5 percent of the U.S. patents granted in 1954 had a woman inventor.⁶

Fred M. Amram, a professor at the General College of the University of Minnesota and an authority on U.S. patenting by women, estimated that about 60,000 woman-inventor patents were granted from 1790 through 1984 or about 1.5 percent of all U.S. patent grants for the period.⁷

Table 2

Number and Percent of Patents issued to Women in the ten selected years: 1905, 1906, 1910, 1911, 1913, 1914, 1918, 1919, 1920 and 1921		
Classified according to purpose served		
Purpose Served	Number	Percent
Agriculture, Forestry, and Animal Husbandry	221	4.4
Mining, Quarrying, Metal Smelting Equipment and Materials	14	0.3
Manufacture	223	4.4
Structural Equipment and Materials	208	4.2
Transportation	345	6.9
Trade	71	1.4
Hotel and Restaurant Equipment	10	0.2
Steam Laundry, Dyeing, and Cleaning Establishment Equipment	6	0.1
Dressmaker and Milliner Supplies	118	2.4
Office Supplies and Equipment	71	1.4
Fishing	9	0.2
Household	1385	27.6
Supplies for Use in Industry, Agriculture, Commerce, Home	378	7.5
Scientific Instruments, Lab Equipment, Meters, Scales, etc.	76	1.5
Ordnance, Firearms, and Ammunition	22	0.4
Personal Wear and Use	1090	21.7
Beauty Parlor and Barber Supplies	46	0.9
Medical, Surgical, and Dental Equipment	227	4.5
Safety and Sanitation	129	2.6
Education	75	1.5
Arts and Crafts	67	1.3
Amusement	211	4.2
Miscellaneous	14	0.3

SOURCE: *Bulletin of the Women's Bureau No. 28: Women's contributions in the field of invention*, U.S. Department of Labor, Women's Bureau (Washington, D.C.: Government Printing Office, 1923)

It is cautioned that the number of early woman-inventor patents is not necessarily fully reflective of women's creative efforts at that time on inventions that were eventually patented. For example, at one time it was not uncommon in the United States for a man to receive a patent for an invention that was actually invented by a woman, typically his wife.⁸ Thus early history of U.S. patenting by women may present an incomplete picture of the patenting efforts by women.

Methodology of the Current Study

Study Limited to U.S. Patents of U.S. Origin

The PTO does not require persons who are granted patents to identify themselves as male or female. Therefore, to identify which patents include a woman inventor (i.e., woman-inventor patents)⁹, the given names of inventors, identified within each patent, have been examined. Because it is more difficult to identify foreign given names as male or female, this study is limited to U.S. patents of U.S. origin, that is, U.S. patents whose first-named inventor on the patent, male or female, resided in the United States at the time of grant. Thus women inventors who did not reside in the U.S. at the time of patent grant are

essentially excluded from this study. The study further is limited to those patents which have issued since 1977, the first year for which all patents have complete inventor data in the TAF data base.

Name Matching

This study was performed through the creation of a file of U.S. origin woman-inventor patents. This file was generated by computer matching the given names of inventors listed on the front page of each patent against a file of female-only given names. Only those patents having an inventor with a given name which matched a name in the female-only file were added to the file of woman-inventor patents. Inventors having given names which are male-only or which could not be easily characterized as male or female were assumed to be male.¹⁰ The resulting file of woman-inventor patents has been used in the generation of the statistical tables and charts presented in this report. However, since the method used to identify woman-inventor patents is somewhat inexact, the results presented must be regarded as approximations. Although the extent of any errors resulting from this methodology are unclear, both the results and the methodology are consistent with other recent studies on women inventors.¹¹ It is noted, however, that the use of alternate spellings for female given names in addition to female given names which are not included in the TAF's list of female-only given names are factors which may serve to reduce the number of identified woman-inventor patents.

Relative Importance of Patents

Some patents are clearly more significant than others. As this is a quantitative study, however, it does not address the relative importance or significance of individual patents.

Patenting Statistics For The Twenty Year Period, 1977-1996

According to the TAF file of woman-inventor patents, 56,063 of the U.S. origin patents issued from 1977 to 1996 include a woman inventor. This represents 5.7 percent of the U.S. origin patents issued during the period.

The number of annually granted, U.S. origin woman-inventor patents increased by five and a half times from 1977 to 1996 (Figure 1) and the percentage of annually granted, U.S. origin patents which include a woman inventor increased from 2.6 percent in 1977 to 9.2 percent in 1996 (Figure 2).

The percentage of U.S. origin patents issued during the twenty year period which include a woman inventor compares somewhat favorably with figures for France and Sweden at the beginning of the 1980's; at that time, it is estimated that 1.2 percent and 1.0 percent, respectively, of the annual patent grants of those countries were to women inventors.¹² This suggests that the percentage of U.S. patents which include a woman inventor, when all countries of origin are considered, may be less for the 1977 to 1996 period than the percentages presented in this report (U.S. origin patents alone).

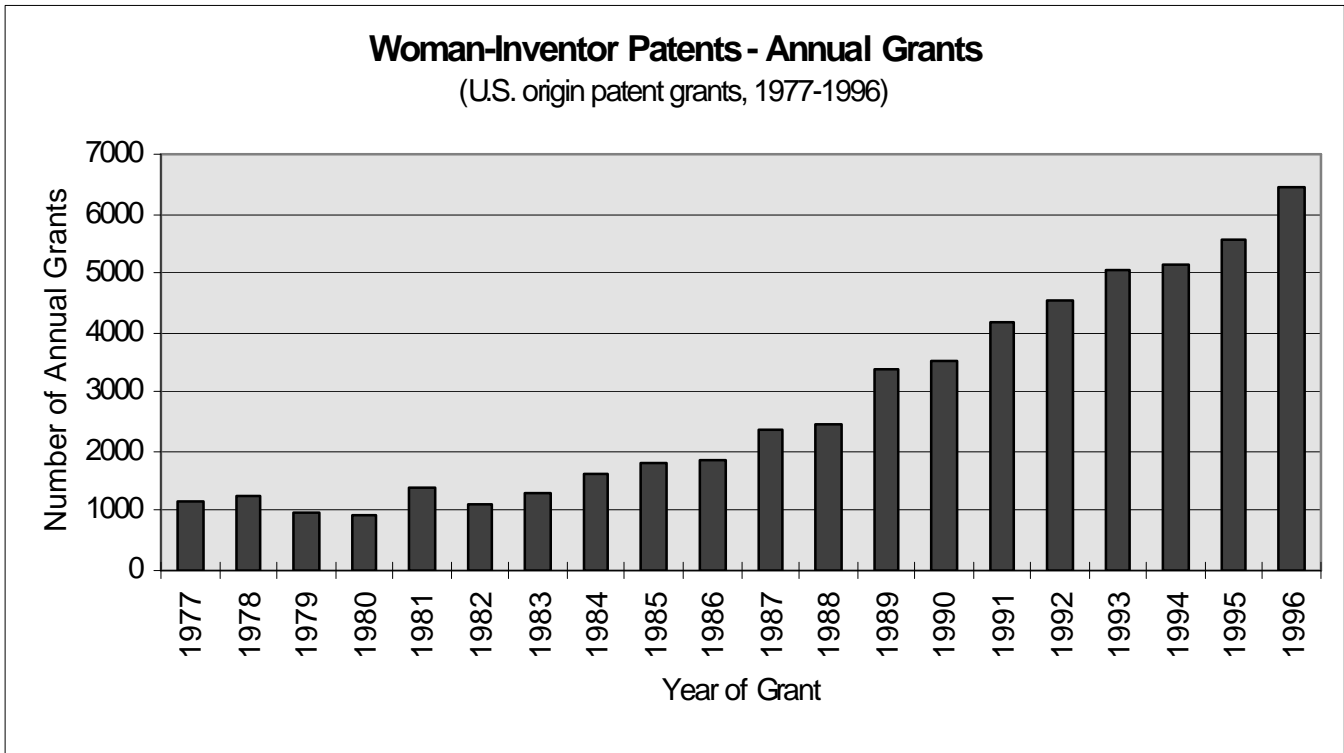


Figure 1 Annual Grants of U.S. Origin Woman-Inventor Patents, 1977-1996
(Appendix Table 6)

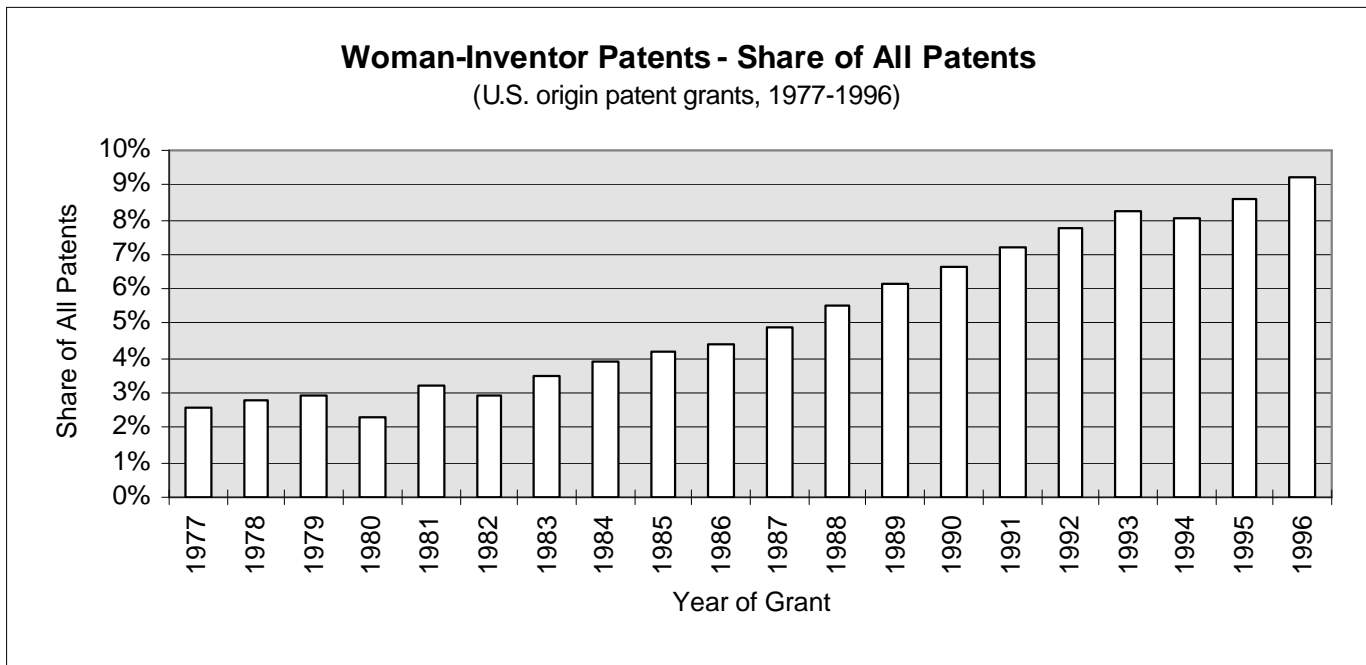


Figure 2 Share of U.S. Origin Patents Which Have A Woman Inventor, 1977-1996 Grants
(Appendix Table 1-1 and 1990 Appendix Table 1-1)

By Patent Type

Patents issued by the PTO fall into one of six categories which are described above. Most of the patents are either utility patents or design patents which together account for 99 percent of the patents issued during the 1977 to 1996 period.

Utility patents (82.6 percent) and design patents (16.4 percent) constitute the majority of the U.S. origin woman-inventor patents issued between 1977 and 1996 with plant patents (0.5 percent) and other patent categories (0.5 percent) making up the remainder of the total (Figure 3).

During the 1977 to 1996 period, the utility, design, and plant patent categories all reflected the overall rise in woman-inventor patent grants as did the other patent categories as a group. The design and plant patents granted during the period contain a higher percentage of woman-inventor patents than do the utility patents; however, the utility patent grants show a substantial gain in percentage share for the 1977 to 1996 period (Figure 4).

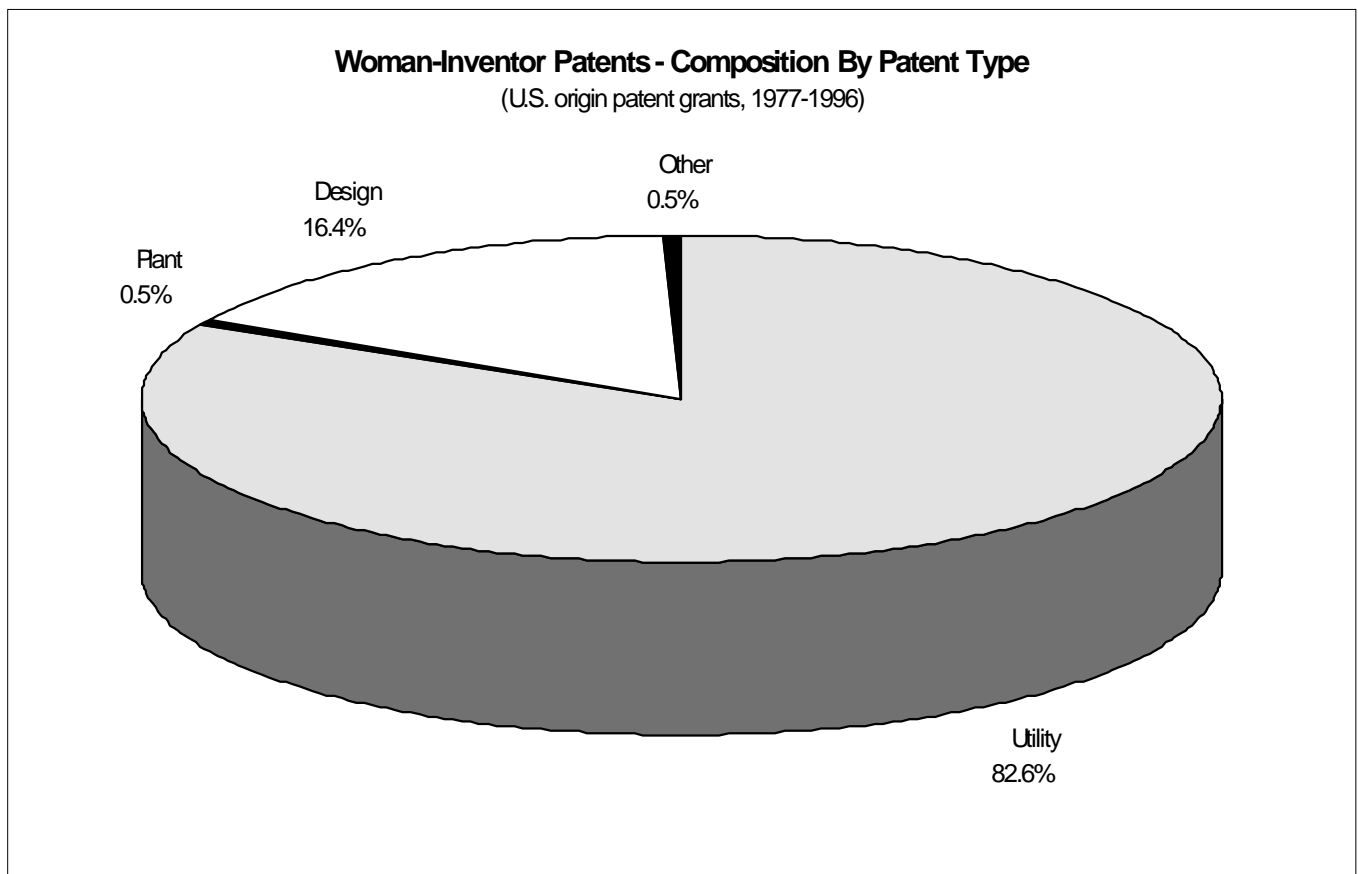


Figure 3 Woman-Inventor Patents, Composition By Patent Type, 1977-1996 Patent Grants of U.S. Origin
(data from Appendix Table 1-2)

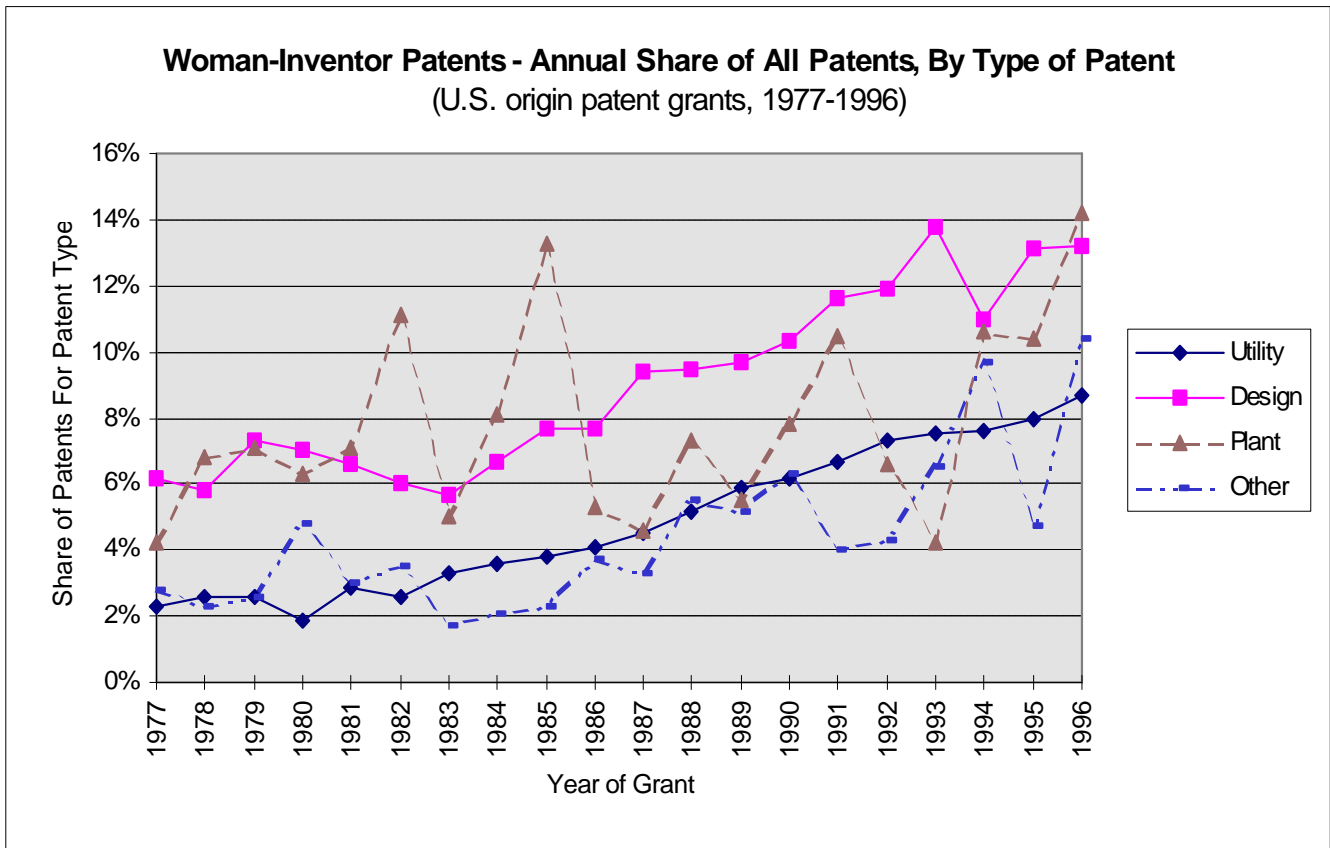


Figure 4 Annual Share of U.S. Origin Patents Which Have A Woman Inventor, By Patent Type, 1977-1996 grants
 (Appendix Table 1-1 and 1990 Appendix Table 1-1. See the explanatory note on the introductory page to the 1990 Appendix Tables.)

By Technology

Utility patents, for the purposes of this study, have been roughly divided into chemical, electrical, and mechanical technology categories based on their primary or "original" classification within the United States Patent Classification System (USPCS).

Examined on this basis, patents pertaining to chemical technologies show, by far, the most participation by women inventors. Omitting those patents having no current technology assignment (less than 0.1 percent of the patents), 49.5 percent or nearly half of the U.S. origin woman-inventor patents issued during the 1977 to 1996 period pertain to chemical technologies, while 36.2 percent pertain to mechanical technologies, and only 14.3 percent pertain to electrical technologies (Figure 5).

U.S. origin utility patents pertaining to chemical technologies show the highest percentage of woman-

Woman-Inventor Patents - Composition By Patented Technology
(U.S. origin patent grants, 1977-1996)

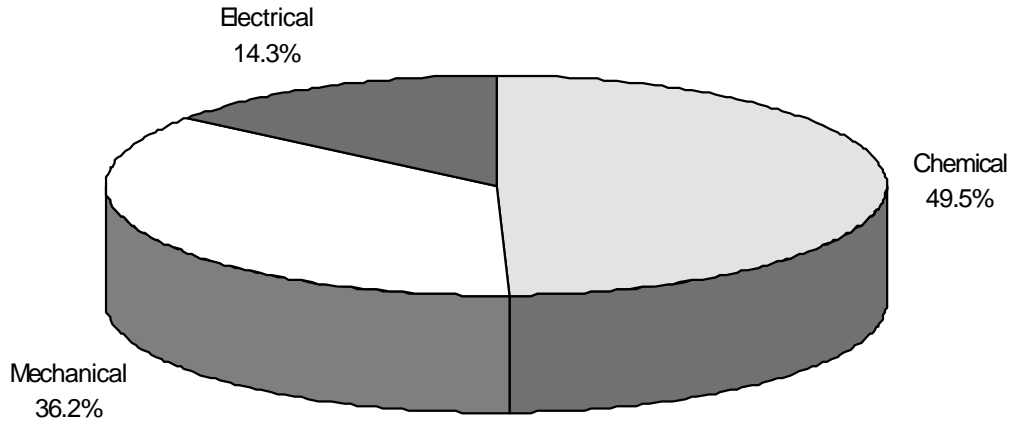


Figure 5 Woman-Inventor Patents, Composition By Technology, 1977-1996 Grants of U.S. Origin
(data from Appendix Table 1-2)

Woman-Inventor Patents - Annual Share Of All Patents, By Technology
(U.S. origin patent grants, 1977-1996)

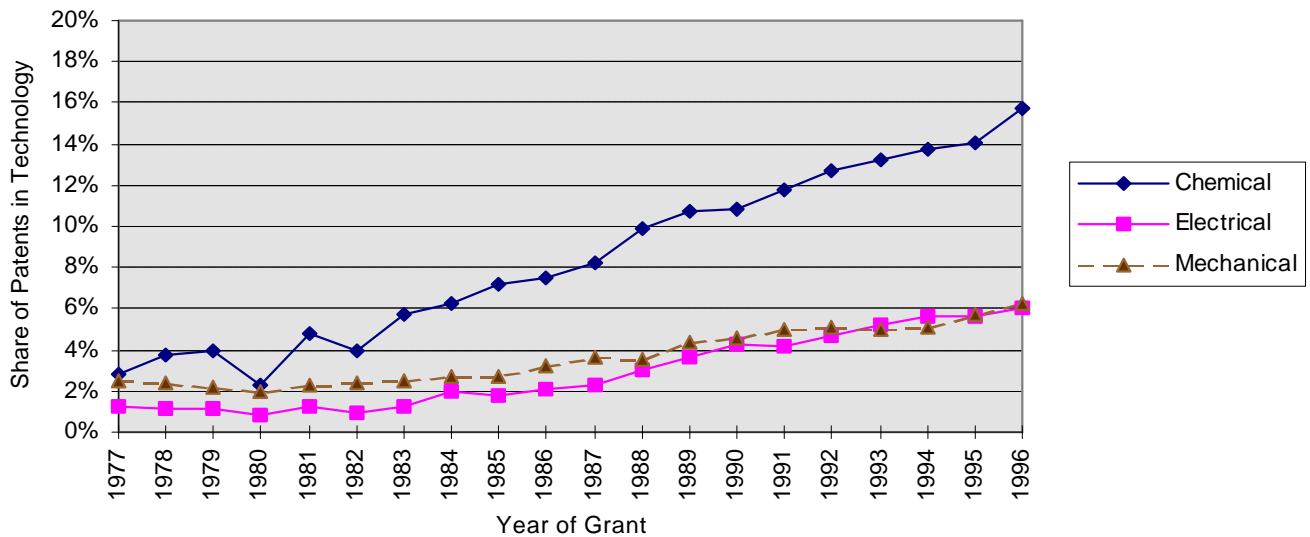


Figure 6 Annual Share of U.S. Origin Patents Which Have A Woman Inventor, By Technology, 1977-1996 Grants
(Appendix Table 1-1 and 1990 Appendix Table 1-1. See the explanatory note on the introductory page to the 1990 Appendix Tables.)

inventor patents. Utility patents pertaining to chemical and electrical technologies displayed a substantially larger gain in share from 1977 to 1996 as compared with patents pertaining to mechanical technologies as is illustrated by Figure 6.

Of the USPCS utility classes used to categorize patent technology which were active in 1996, i.e., those in which 200 or more newly issued patents received primary classification in 1996, the fifteen containing the highest number of woman-inventor patent grants for the twenty year period include twelve pertaining to chemical technologies, three pertaining to mechanical technologies and none pertaining to electrical technologies. The three classes of technology having the highest share of woman-inventor patent grants in 1996 are (1) *Chemistry: Natural Resins or Derivatives; Peptides or Proteins; Lignins or Reaction Products Thereof* (27.8 percent), (2) *Chemistry: Molecular Biology and Microbiology* (26.4 percent), and (3) *Organic Compounds, Class 548* (26.1 percent). See Appendix Table 2-2.

Of the USPCS utility classes active in 1996, the fifteen showing the lowest percentage of patents including a woman inventor during the period include twelve classes pertaining to mechanical technologies, three pertaining to electrical technologies and none pertaining to chemical technologies. The three active classes with the lowest percentage of woman-inventor patents are Brakes (0.0 percent), Fluid-Pressure and Analogous Brake Systems (0.0 percent), and Joints and Connections (0.0 percent). See Appendix Table 3-2.

By Ownership

Owners of U.S. origin patents have been divided into three categories-- corporations, U.S. Government, and individuals-- based on ownership information available at the time of patent grant. The corporation category includes legally incorporated entities and, in addition, other nongovernment organizations such as small businesses, universities, and a few foreign based entities. The U.S. Government ownership category includes Federal government entities and the individual ownership category includes U.S.-resident owners not included in the other categories, often the inventor herself.

During the twenty year period, 65.7 percent of the woman-inventor patents granted were owned by corporate/nongovernment organizations at the time of grant, while 32.0 percent were owned by individuals, and 2.3 percent were owned by U.S. Government entities (Figure 7).

Of the U.S. origin patents granted during the period, woman-inventor patents constituted 5.3 percent of all corporate/nongovernment organization owned patents, 5.6 percent of all U.S. Government entity owned patents, and 6.8 percent of all U.S.-resident individual owned patents (Appendix Table 4-1).

However, women inventors are rapidly increasing their participation in patenting, especially in U.S. origin patents owned by corporate/nongovernment and U.S. Government organizations, as is evidenced by the estimated five-fold increase in the percentage of U.S. origin patents which include a woman inventor within those two ownership categories from 1977 to 1996 (Figure 8).

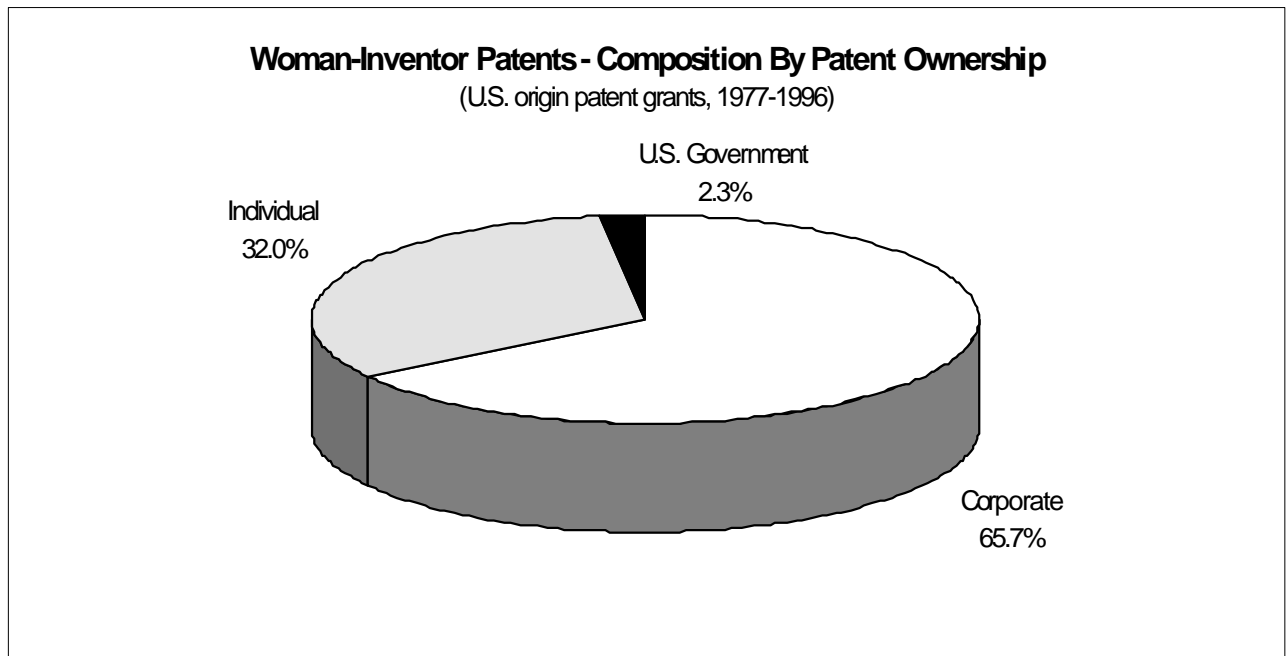


Figure 7 Woman-Inventor Patents, composition By Patent Ownership, 1977-1996 Grants of U.S. Origin
(data from Appendix Table 4-2)

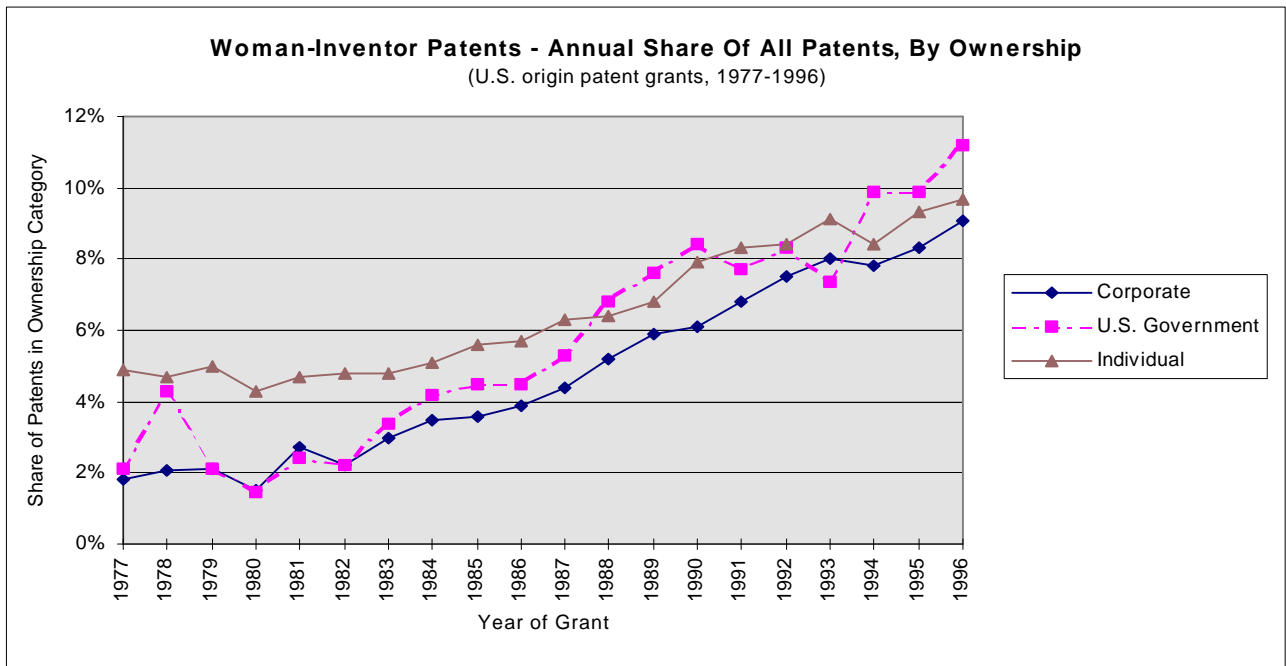


Figure 8 Annual Share of U.S. Origin Patents Which Have A Woman Inventor, By Ownership
(Appendix Table 4-1 and 1990 Appendix Table 4-1)
(1977-1982 shares are estimated using data in 1990 Appendix Table 1-1. See the explanatory note on the introductory page to the 1990 Appendix Tables.)

During the twenty year period, the corporate organizations named most frequently as owners of U.S. origin woman-inventor patents at the time of grant are International Business Machines Corporation (1,272 patents), General Electric Company (810 patents), and Eastman Kodak Company (738 patents) (Appendix Table 5-1). The U.S. Navy (264 patents) topped the list of Federal Government organizations owning U.S. origin woman-inventor patents granted during the period (Appendix Table 5-2).

By State Of Residence

About 35 percent of the U.S. origin woman-inventor patents issued during the 1977 to 1996 period originated from California, New York, or New Jersey (i.e., the first-named inventor of those patents, who may or may not have been a woman, resided in one of those three states at the time of grant). Roughly two-thirds of all U.S. origin woman-inventor patents issued during the period originated from one of nine states. The nine states are, in descending order, California (8397), New York (6305), New Jersey (4704), Illinois (3023), Pennsylvania (2983), Texas (2872), Ohio (2748), Michigan (2487), and Massachusetts (2434). The number of woman-inventor patents is shown in parentheses. See Appendix Table 6 for a complete listing of state information.

Prolific Women Inventors

Thirty-two women inventors were identified who received fifteen or more U.S. origin patents during the five year period from 1992 to 1996 (Appendix Table 8). Based on patent ownership information at the time of grant, a majority of these women appeared to be affiliated with organizations. The most prolific recipient identified for the period, Jane Ancona of New York, received eighty-two patents from 1992 through 1996.

FUTURE TRENDS

From 1977 to 1996, U.S. origin patent grants which include a woman inventor have increased both in number and as a percentage of all U.S. origin patent grants. Employment figures continue to display increasing participation by women in engineering and science disciplines during this period,¹³ and as a result, U.S. origin patents which include a woman inventor should continue to climb both in numbers and as a percentage of total patent grants.

NOTES

1. *Buttons to Biotech - U.S. Patenting By Women, 1977 to 1988*, U.S. Patent and Trademark Office, Office of Documentation Information- Technology Assessment and Forecast Program, January 1990.
2. F.M. Amram and J.A. Morgan, " 'Inventor' is a masculine word," *U.S. Woman Engineer* (December, 1980), p. 2.
3. *Women Inventors To Whom Patents Have Been Granted By the United States Government, 1790 To July 1, 1888* (Washington, D.C.: Government Printing Office, 1888), *Women Inventors To Whom Patents Have Been Granted By the United States Government, July 1, 1888 To October 1, 1892, Appendix No. 1* (Washington, D.C.: Government Printing Office, 1892), and *Women Inventors To Whom Patents Have Been Granted By the United States Government, October 1, 1892 to March 1, 1895, Appendix No. 2* (Washington, D.C.: Government Printing Office, 1895). All lists were compiled under the direction of the Commissioner of Patents.
4. J. Rossman, "Women Inventors," *Journal of the Patent Office Society* (September, 1927), p. 21. Rossman quotes a figure of 1 out of every 1,000 patents as being a woman-inventor patent but 1 out of every 100 appears to be the more accurate figure.
5. *Bulletin of the Women's Bureau No. 28: Women's contributions in the field of invention*, U.S. Department of Labor, Women's Bureau (Washington, D.C.: Government Printing Office, 1923), p. 13.
6. Fred M. Amram and Jane A. Morgan, " 'Inventor' is a masculine word," *U.S. Woman Engineer* (December, 1980), p. 2. The 1954 study quoted by Amram and Morgan was published in *Independent Inventors and the Patent System*, a study of the Subcommittee on Patents, Trademarks, and Copyrights of the Committee on the Judiciary (study number 28, 1961), by C.D. Tuska, p. 4.
7. F. Amram, "The innovative woman," *New Scientist*, (May 24, 1984), p. 10.
8. *Ibid.*, p. 11.
9. Patents issuing in recent years often have multiple inventors and "woman-inventor patent," as used in this report refers to a patent which includes a woman inventor even though the woman may not be the sole inventor.
10. The three files of male-only, female-only, and not easily characterized given names were generated by TAF studies in 1983 and 1986 (unpublished) by first adding given names from a standard name-source book (Rule, *Name Your Baby*, 1980) to the appropriate files. Inventor given names which did not match any of the names in the three resulting name files were then reviewed manually and a subjective decision was made to add them to one of the three name files.
11. Studies by the Patent Office, the Department of Labor, Tuska, and Amram all appear to have used name matching of given names to determine the gender of the inventor(s).

12. F. Moussa, *Les Femmes Inventeurs Existent: Je les ai rencontrées* (Geneve, 1986), p. 194.
13. *Science and Engineering Indicators - 1996*, National Science Board (Washington, D.C., Government Printing Office, 1987) p. 3.12 to 3.14.

APPENDIX TABLES

These appendix tables are excluded from this excerpt.

Selected APPENDIX TABLES

from the Original 1990 report,

Buttons to Biotech -- U.S. Patenting By Women, 1977 to 1988

(these appendix tables are excluded from this excerpt)

This separate appendix includes selected tables from the original report titled, *Buttons to Biotech -- U.S. Patenting By Women, 1977 to 1988*, published by the U.S. Patent and Trademark Office in January, 1990.

In overlapping years, the patent counts, as presented in the original 1990 report tables, may differ slightly from the counts presented in the updated 1977-1996 report. These differences are a result of TAF Program efforts to correct newly identified data errors and to incorporate new data.

Please note:

The 1990 Appendix Tables 4-1 to 4-3 (of the original report) are included in this appendix even though those data were calculated using a different definition for the ‘U.S. Government’ ownership category as compared to the current report. The differences in definitions should be minor enough for the data to be used in the current report for estimating the 1977 to 1982 woman-inventor percentage shares by ownership category (see Figure 8 of the current report). Comparing patent counts and percentage shares in years common to both the 1990 report (1990 Appendix Tables 4-1 to 4-3) and the current 1998 report (Appendix Tables 4-1 to 4-3) suggests that using the ownership data from the 1990 report along with the data gathered for the current report is not unreasonable.

*U.S. Patent and Trademark Office
Promoting the Progress of Science and the Useful Arts
1790 - 1998*