

LITERATURE CITED

decision making processes importantly but indirectly. Because of various pressures, decision makers find it helpful to have their information restructured for their use in applying it to policy questions.

Looking at these features of the use of the scientific literature, a direction for future growth appears. This direction should involve a major increase in the restructuring of primary information to make it more directly applicable to users' requirements. A variety of special service organizations may perform the restructuring. Information analysis centers are already doing such work in many well-defined subject areas. More generally, the future holds promise of a national network of information systems, with individual component systems focusing on special subjects, missions, or problem areas in which the user will receive prime consideration. New operations for manipulating information will be essential parts of these systems, and a range of new information packages will be produced. Here is a challenge and an opportunity for service and for benefits to scientists and engineers on a nationwide scale.

- (1) Price, D. J. de Solla, "Communication in Science: The Ends—Philosophy and Forecast," *Ciba Foundation Symposium on Communication in Science: Documentation and Automation*, pp. 199–209, J. & A. Churchill Ltd., London, 1967.
- (2) Rossmassler, S. A., "Modification of Dissemination Channels for Scientific Information," *J. CHEM. DOC.*, **9**, 17 (1969).
- (3) *Chem. Eng. News* **47**, 24 (Jan. 13, 1969).
- (4) "How the President Gets His Science Advice: A Visit to OST," *Physics Today*, August 1969.
- (5) "The Role of the Federal Council for Science and Technology, Report for 1963 and 1964," 1965, Superintendent of Documents, Washington, D. C. 25 cents.
- (6) "The Role of the Technical Report in Scientific and Technological Communication," December 1968, PB 180 944, Clearinghouse for Federal Scientific and Technical Information, U.S. Department of Commerce, Washington, D. C.
- (7) "Progress in Scientific and Technical Communication—1968," October 1969, PB 186 400, Clearinghouse for Federal Scientific and Technical Information, U. S. Department of Commerce, Washington, D. C.

Patent Literature: Current Problems and Future Trends*

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The historical growth of U.S. patent issuances is reviewed showing the portion represented by chemical patents, factors affecting future growth of both U.S. and foreign patent documents, forecasts of total and chemical issues of U.S. patents through 1975, and some of the measures taken within the Patent Office to cope with file growth.

When Secretary of State Thomas Jefferson delivered to Samuel Hopkins of Vermont a document bearing, in addition to his own name, the signatures of President Washington and Attorney General Edmund Randolph, he began a procession of steps that has in the years since that 31st day of July 1790 brought to countless inventors and at the same time to the annals of technical literature an ever growing number of U.S. patents. This week, the postal service will perform this same act delivering 1300 patents which make up the latest weekly issue.

At the same time, the printed specifications of these patents will move across the length and breadth of this country and overseas to many foreign lands to add to the pile of documents. With 90 copies of each new specification distributed on patent issue day, more than 6 million individual documents will move this year into

such repositories. And the flow which begins anew with each weekly issue continues for many years as users of patent literature find need to obtain copies from back issues. The sustained demand for such copies which is usually expressed in individual orders for one or two different patent numbers runs at a daily average of nearly 22,000 copies. This adds 5.5 million more copies to shelves and files each year.

Because patents are given consecutive numbers under the practice begun in 1836, the total number of patents issued since then would normally be indicated by the latest issued number. Actually, however, the total is less. This results from the fact that over the years about 3000 prospective patents had to be withdrawn from issue at a time in the issuance process when it was too late to enter substitutes for them. On the other hand, some few patents have half-numbers. Hence, while patent number 3,466,000 will be issued tomorrow (September 9, 1969), it will actually be the 3,463,000th document to enter the public annals.

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In reviewing the past, it is pertinent to note, that the printing of patent specifications was not started until 1869, some 33 years after the first numbered patent was issued. Three years later, Congress authorized the printing of back issues and this work was done gradually over the next 40 years.

With this brief background, let us now consider: first, the rate at which patents in general have been issued over the years; second, the portion of this total growth which is represented by chemical patents; and, third, the factors which could influence the number of patents forthcoming in the next five years.

We will then turn to foreign patents and consider some of the current and prospective forces which influence their flow. Finally, some remarks will be made concerning present and prospective measures which aim at bringing the problems arising from patent literature growth under control.

The pace of growth in U.S. patent documents over the years is shown in the upper curve of Figure 1. The facts which it portrays are already well-covered in public reports. Also illustrated here is the cumulative growth in number of chemical patents issued over the same period. Owing to problems of scale which must show a range of 4 million, the number of chemical patents are barely perceptible on this chart, and, in fact, do not seem to make a showing at all until the 70's—i.e., a hundred years ago.

Figure 2 portrays the same data as Figure 1. But by the seeming trick of a log-scale in which the spread between horizontal lines represents a factor of ten, we are able to amplify greatly visibility of the record of chemical patent issuances relative to total patents. The flat curve seen for the period between the Civil War and World War I, and the increasing distance between it and the upper curve representing all patents, suggest that U.S. invention in the chemical field somewhat lagged developments in other areas during part of that period. This appears more clearly in Figure 3 which shows chemical patents as a cumulative percentage of all patent issues. Figure 4 shows, for each five-year period from 1836 to the present, the number of chemical patent issuances and that the turn of the century marked an upswing which was accelerated in each of the subsequent post-war periods.

The preceding data are shown in Figure 5 as a percentage of total patent issuances for each five-year period.

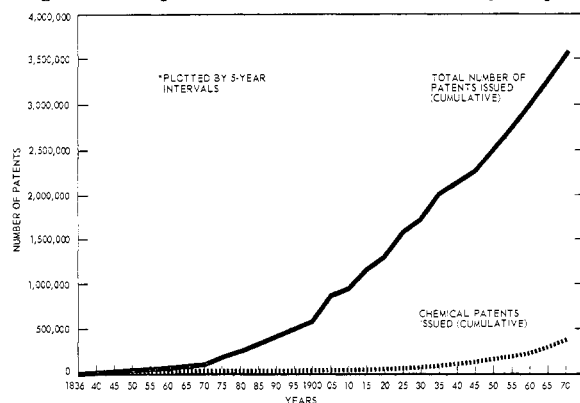


Figure 1. Patent documents (U.S.) entering publication channels

(The data illustrated in Figures 1–5 are listed in detail in Table I.) Evidence is clear that chemical patents have grown in both absolute and relative magnitude to where they now account for 23% of current patent issuances. This is, also, likely to be the ratio for the full five-year period, 1966–1970. And the relative volume of pending applications in the patent examining groups today indicates that the percentage of chemical patents would further increase in the 1971–1975 period, probably reaching 25%.

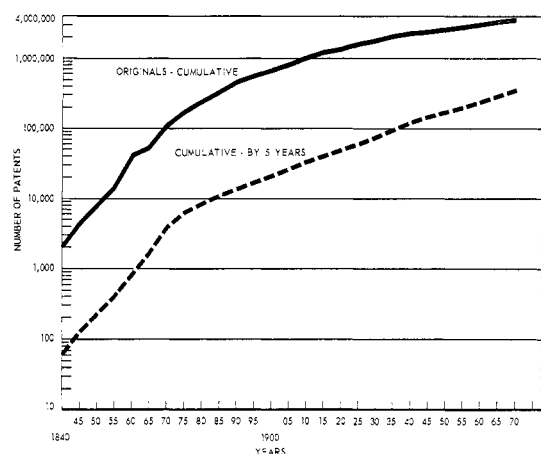


Figure 2. Patent documents (U.S.) entering publication channels

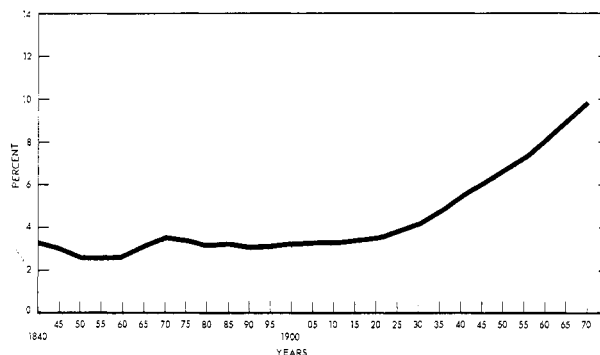


Figure 3. Chemical patent issues as cumulative percentage of total issues

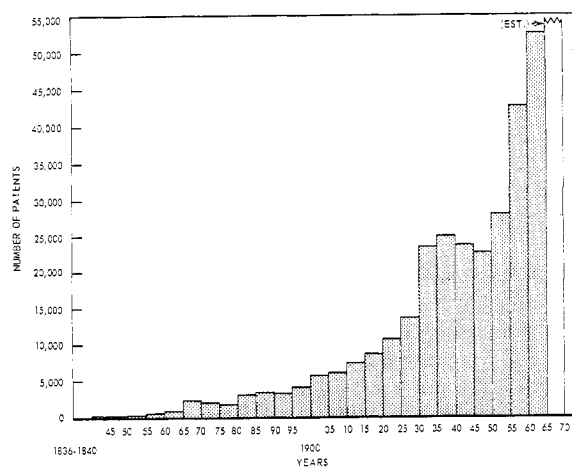


Figure 4. Chemical patent issues

In the foregoing data, I have treated as "chemical patents" all patents which are currently (April 1969) classified "original" in those 36 classes or parts of classes which together define the subject matter announced in the Chemical Section of the Official Gazette. The number and descriptive title of these classes and the number of patents in each of them is shown in Table II.

So much for the retrospective file. What about the future?

For the next several years, the prediction is easy. Patent issues in 1970-1971 will be greater than for any comparable period in the history of the Patent Office. The explanation is this: first, the number of allowed applications flowing

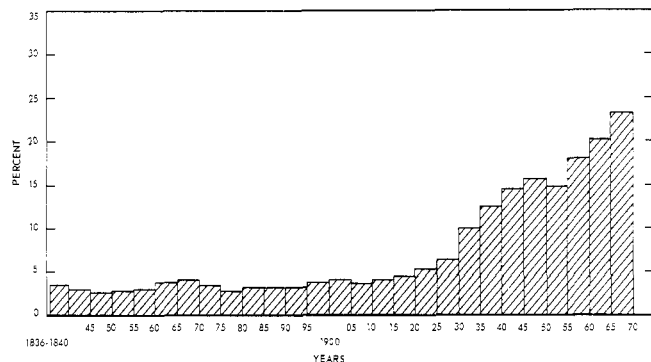


Figure 5. Chemical patent issues as percentage of total issues

Table I. Chemical and Total Patents Issued by Five-Year Intervals

Period	Issues by Period			Cumulative to End of Period		
	Number of chemical patents issued	Total number of patents issued	% of chemical to total issues	Chemical patent issues	Total patent issues	% of chemical to total issues
1836-1840	64	1913	3.3	64	1913	3.3
1841-1845	64	2425	2.6	128	4338	3.0
1846-1850	86	3517	2.4	214	7855	2.7
1851-1855	155	6144	2.5	369	13999	2.6
1856-1860	458	16996	2.7	827	30995	2.6
1861-1865	761	20779	3.6	1588	51774	3.1
1866-1870	2314	58833	3.9	3902	110607	3.5
1871-1875	1994	61024	3.2	5896	171631	3.4
1876-1880	1676	64496	2.5	7572	236127	3.2
1881-1885	2975	97357	3.0	10547	333484	3.2
1886-1890	3250	110493	2.9	13797	443977	3.1
1891-1895	3194	108515	2.9	16991	552492	3.1
1896-1900	4001	112325	3.6	20992	664817	3.2
1901-1905	5586	143791	3.9	26578	808608	3.3
1906-1910	5959	171560	3.5	32537	980618	3.3
1911-1915	7251	186241	3.9	39788	1166409	3.4
1916-1920	8520	197644	4.3	48308	1364053	3.5
1921-1925	10562	203977	5.2	58870	1568030	3.8
1926-1930	13613	219384	6.2	72483	1787414	4.1
1931-1935	23423	239092	9.8	95906	2026506	4.7
1936-1940	24921	200902	12.4	120827	2227408	5.4
1941-1945	23736	164438	14.4	144563	2391846	6.0
1946-1950	22577	144160	15.7	167140	2536006	6.6
1951-1955	28107	192897	14.6	195247	2728903	7.2
1956-1960	42681	237768	18.0	237928	2966671	8.0
1961-1965	52411	260058	20.2	290339	3226729	9.0
1966-1970*	74866	328394	22.8	365205	3555123	10.3

* Data for 1969 and 1970 have been projected to complete the five-year interval.

from the Examining Corps is at or near the record level of 70,000. Second, there is a backlog of previously allowed applications which await publication. In the current fiscal year which ends June 30, 1970, about 70,000 patents will be printed. For fiscal years 1971 and 1972, the projected numbers are 83,000 and 80,000, respectively.

To attain these objectives, the weekly patent issue rate is scheduled to increase next Spring from the present level of 1300 to 1600. The timing is dependent upon the successful implementation of plans to utilize electronic composition methods which will augment initially the present hot metal composition and eventually replace it. With elimination of the printing backlog, expected by November 1971, the issue rate would nominally level off at about 1360 a week or nearly 71,000 patents a year.

However, several factors could influence the size of the numbers.

One is the volume of applications received. If the input growth of recent years continues, and the quality of invention does not change the patentability rate of about 70%, we could expect an approximate annual increase of 3% in the number of patents. This translates to about 2000 more patents a year. This, of course, assumes that examiner manpower or the effective productivity of that manpower would remain abreast of the growing load.

The second factor is reduction in the backlog of pending applications. The aim of the Patent Office is to achieve, by the end of fiscal year 1975, a current condition under which applications would be disposed of within 18 months of their filing. At an annual rate of 100,000 application receipts, for example, this would mean a maximum inventory of work in process of 150,000 applications. Thus, to attain this condition the excess of cases would have to be eliminated. This, alone, would add almost 20,000 patents to the document output over the next five years.

A third factor involves the new category of documents called Defensive Publications. An applicant, who under certain conditions respecting waiver of rights to patent in a pending application, may elect to terminate prosecution of his application and obtain publication of its principle features. The number of Defensive Publications as yet is very small. Some attribute this to the fact that the authority for them rests on administrative rule and believe that if they were given a statutory foundation, the numbers would greatly increase, without appreciably diminishing the number of patents issued.

Thus, in looking to the future of technical literature for the period through fiscal year 1975, we project the publication of 482,000 new patent documents, which would bring the total to nearly 4 million. Looking backward again, we note that it took 75 years to aggregate the first million; another 25 years to double that number; 26 more years to bring it to 3 million; and, finally, only 13 years to add another million. These figures, of course, relate to over-all patent documents whereas in terms of the interest here today we should ask: "What about chemical patent literature?"

Projecting the historical growth rates we have previously examined and extending the changing proportionate relationship between chemical patents and the total, I expect that nearly 120,000 chemical patents will be added through 1975, bringing that body of literature to well over 450,000 documents.

Table II. Chemical Art as Defined by U. S. Patent Office Official Gazette Classification

Class	Title	File Size (U. S. Patents as of Dec. 1968)		
		Originals	Cross-References	Total
8 (subs. 1-142)	Bleaching and Dyeing; Fluid Treatment and Chemical Modification of Textiles and Fibers	5,634	15,855	21,489
21	Preserving, Disinfecting and Sterilizing	1,811	2,414	4,225
23	Chemistry	21,290	36,153	57,443
29 (subs. 180-199)	Metal Working	2,199	5,206	7,405
44	Fuel and Igniting Devices	3,494	5,524	9,018
48	Gas, Heating and Illuminating	5,998	4,147	10,145
51 (subs. 293-309)	Abrading	886	1,409	2,295
65	Glass Manufacturing	7,074	14,778	21,852
71	Chemistry, Fertilizers	2,731	8,775	11,506
75	Metallurgy	12,798	21,586	34,384
96	Photographic Chemistry, Processes and Materials	6,613	12,121	18,734
99 (subs. 1-233)	Foods and Beverages	10,948	16,407	27,355
106	Compositions, Coating or Plastic	14,471	31,427	45,898
117	Coating: Processes and Miscellaneous Products	14,610	61,518	76,128
127	Sugar, Starch and Carbohydrates	1,273	1,749	3,022
134 (subs. 1-42)	Cleaning and Liquid Contact with Solids	869	3,001	3,870
136	Batteries	7,346	9,918	17,264
148	Metal Treatment	6,227	13,228	19,455
149	Explosives and Thermic Compositions	1,768	6,677	8,445
156	Adhesive Bonding and Miscellaneous Chemical Manufacture	10,583	31,166	41,749
161	Stock Material and Miscellaneous Articles	6,386	29,358	35,744
162	Paper Making and Fiber Liberation	5,478	9,886	15,364
176	Nuclear Reactions and Systems	1,767	4,264	6,031
195	Chemistry, Fermentation	2,740	6,236	8,976
196	Mineral Oils: Apparatus	1,121	7,311	8,432
201	Distillation: Processes, Thermolytic	545	1,919	2,464
202	Distillation: Apparatus	2,753	8,976	11,729
203	Distillation: Processes, Separatory	1,632	6,036	7,668
204	Chemistry, Electrical and Wave Energy	11,723	20,367	32,090
208	Mineral Oils: Processes and Products	10,644	17,962	28,606
210 (subs. 1-64)	Liquid Purification or Separation	1,447	5,247	6,694
252	Compositions	19,252	62,277	81,529
260	Chemistry, Carbon Compounds	109,909	294,508	404,417
263 (subs. 52, 53)	Heating	383	343	726
264	Plastic and Non-Metallic Article Shaping or Treating: Processes	10,171	30,892	41,063
424	Drug, Bio-Affecting and Body Treating Compositions	10,368	33,292	43,660
Totals:		334,942	841,933	1,176,875

Although the number of U.S. patents exceeds that of any other country, foreign patents, in the aggregate, constitute the predominant part of world patent literature items. Accordingly, we must consider the past and look at current events in world wide patent practice to get an idea about what might happen in this area of interest.

While the U.S. Patent Office does not possess all of the world patent literature, its document collections contain most of it. There are more than 8.8 million such

items in its numerical files and this number is growing continuously with the receipt of current publications from 26 countries. Of the estimated 384,000 foreign patent documents published in 1967, about 85% of them, or nearly 320,000 items have thus far been received. This compares with 278,000 and 293,000 total items received for 1965 and 1966, respectively, and nearly 400,000 expected to be received of the 1969 foreign issuances. As most of these documents are in foreign languages,

they present difficult problems in documentation and information handling.

There are at least three major factors which underlie current and future growth in world patent literature. They are:

- Rate of invention.
- Duplication of international patent filing.
- Significant changes in national patent laws or international patent practice.

Each is considered, in turn.

Reports of recent years show an average annual increase at the rate of 3% in applications for patent filed in a given country by residents of that country. Assuming no drastic changes in economic and socio-political circumstances which might affect the milieu and incentive for invention, this rate of increase may be considered indicative of future application filings and the subsequent patent documents stemming from them.

A number of these applications will be filed also in one or more other countries and eventually generate an additional quantity of publications.

An example of this is seen in Figure 6 which shows the application flow between the United States and 13 other countries. The width of the dark arrows shows the relative volume of filing abroad by U.S. applicants in the indicated countries. The light arrows show the reverse flow from these same countries. The bar charts in the lower left-hand corner show comparisons of the volume of outflowing applications for the two same periods.

In the much larger perspective of worldwide practice, Figure 7 shows that:

there were 620,000 applications filed worldwide in 1965. 220,000 of them were filed in only one country, usually the applicant's home country.

another 68,000 national applications were considered important enough by their owners to form the basis of later filing in other countries.

they generated an additional 330,000 foreign applications—a ratio of nearly 5 to 1.

Thus, over half of the applications filed worldwide in 1965 were duplicate or equivalent applications.

Accordingly, as growth occurs in invention and in national application filings on them, there is a likely incidence of growth in foreign filings. If present trends and practices in international filing continue, total worldwide filings by 1975 would approach 900,000. Nearly one-half million of them would be duplicate or multiple filings, generated by a still relatively small number of inventions.

While we have been projecting in terms of applications, we are, in effect, indicating potential enlargement in volume of patent document publications. These increases are going to be seen in a greater number of U.S. patents maturing from a larger number of applications received from outside the country, but an even greater outpouring of documents will flow from other countries based on receipts of applications from the U.S. and from each other.

This brings me to the third major influence bearing on patent literature trends, namely, changes in national patent laws. Several countries, overburdened by staggering workloads arising from foreign origin applications, have recently changed their patent laws, seeking relief in a deferred examination system. The Dutch, whose pending cases were 85% foreign, took this step over five years

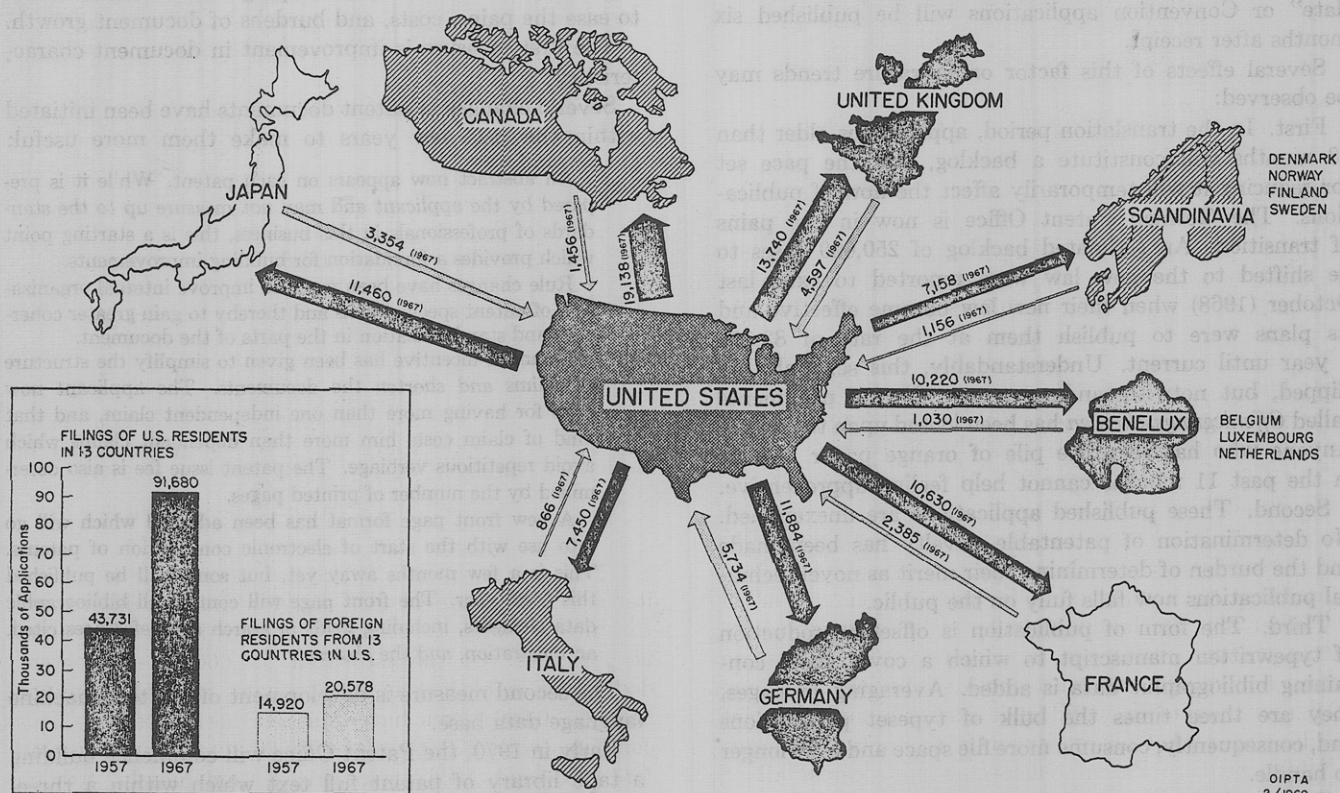


Figure 6. Patent application flow between the U.S. and 13 foreign countries (1967)

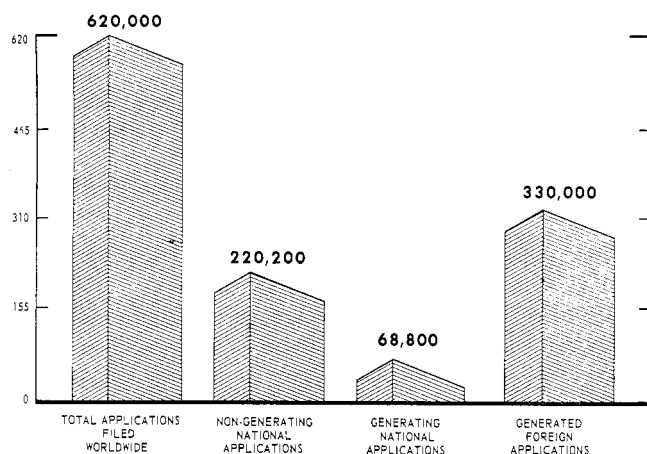


Figure 7. Breakdown by origin of patent applications filed throughout the world (1965)

ago, and the Federal Republic of Germany went on this basis within the past year. Other countries have this move under consideration, principally Japan whose Patent Office is said to have more than 600,000 pending applications.

One of the features of this system is the early publication of applications. This may be in the form of printing documents, as is the case with the Dutch and Germans. Some other countries merely lay the applications open to public inspection such as the practice in the Nordic countries and Australia. Publication usually occurs 18 months from the date the application was first filed. Because the Paris Convention enables an applicant to file in a second country within one year and obtain the benefit of his first filing date, these so-called "priority date" or Convention applications will be published six months after receipt.

Several effects of this factor on literature trends may be observed:

First. In the translation period, applications older than 18 months will constitute a backlog, and the pace set for reducing it will temporarily affect the flow of publications. The German Patent Office is now in the pains of transition. An estimated backlog of 250,000 cases to be shifted to the new law were reported to exist last October (1968) when their new law became effective and its plans were to publish them at the rate of 83,000 a year until current. Understandably, this schedule has slipped, but notwithstanding, a new flow of documents called *Offenlegungsschriften* has been loosed upon the world. Anyone who has seen the pile of orange paper created in the past 11 months cannot help feeling apprehensive.

Second. These published applications are unexamined. No determination of patentable novelty has been made and the burden of determining their merit as novel technical publications now falls fully on the public.

Third. The form of publication is offset reproduction of typewritten manuscript to which a cover sheet containing bibliographic data is added. Averaging 18 pages, they are three times the bulk of typeset publications and, consequently, consume more file space and take longer to handle.

Fourth. Notwithstanding the drawbacks noted, these documents require careful attention because they com-

municate new information earlier than conventional printed patents. Descriptions of inventions bottled up in pending applications which are being processed in confidence in the U.S. Patent Office will, for example, be "on the streets" a year earlier than the average U.S. patent.

In summing the trends in patent literature, we see growth in the number of documents arising from the simple fact that the number of inventions will continue to rise, and that their owners will continue to seek protection in patent processes both at home and abroad. Document growth will be compounded by the practice of publishing all applications in a number of countries whereas, under prior practice, only those which survived examination processes were published. This will increase by nearly 50% the sustained document output of certain countries.

The estimated effect of these developments is that the added volume of the first published documents alone could total more than 3 million by the end of 1975. This assumes that Japan will adopt an early publication law, although it is understood that the Diet has recently turned down such proposed legislation. The year-by-year estimates of output are:

1970 - 442,000	1971 - 603,000	1972 - 606,000
1973 - 464,000	1974 - 487,000	1975 - 511,000

The problems of space, file management, information search, and related problems which arise from the burgeoning world patent literature are well known. The following are some countervailing measures or trends, if any, which exist or seem to be developing within Patent Offices to ease the pains, costs, and burdens of document growth.

The first measure is improvement in document characteristics.

Several changes in patent documents have been initiated within the past few years to make them more useful:

An abstract now appears on each patent. While it is prepared by the applicant and may not measure up to the standards of professionals in this business, this is a starting point which provides a foundation for building improvements.

Rule changes have been made to improve internal organization of patent specifications and thereby to gain greater coherence and standardization in the parts of the document.

Financial incentive has been given to simplify the structure of claims and shorten the documents. The applicant now pays for having more than one independent claim, and that kind of claim costs him more than dependent claims which avoid repetitious verbiage. The patent issue fee is also determined by the number of printed pages.

A new front page format has been adopted which will go into use with the start of electronic composition of patents. This is a few months away yet, but some will be published this fiscal year. The front page will contain all bibliographic data elements, including fields of search and references cited, an illustration, and the abstract.

The second measure is development of full text machine language data base.

Early in 1970, the Patent Office will commence building a tape library of patent full text which within a three-year period will grow to embrace all current issues of patents. In time, parts of the retrospective patent file

will be added. This file will provide for direct machine transfer and dissemination of patent information for computerized data systems. While not intended to displace graphic data—whether in paper or microfilm—this form of information resource will help some users to cope with the document problem.

The third measure is reduction of files through use of microfilm.

The Patent Office has developed microfilm systems and laid plans for converting examiner and public search files from vast paper collections to microfilm. A unitized microform, called the aperture card, which is designed to hold up to eight pages of information at a 22-to-1 reduction ratio has been adopted for this purpose. Only one such card is required for each of nearly 90% of U.S. patents. A search reader with push button controlled mechanized card movement and other new features to facilitate patent searching has been developed as part of this system and is presently in pilot operational use. Patent aperture cards in both numerical and classified arrangement will become available to the public at economical rates. Comparable developments are on-going in other countries, and German patent documents are already disseminated in aperture cards. A basis for document exchange in aperture cards among patent offices has been established through ICIREPAT (Paris Union Committee for International Cooperation in Information Retrieval Among Patent Offices).

In the business of filling orders for patent copies, the Patent Office produces more than 7000 documents a day from unitized microfilm kept in a graphic data store. By its process of on demand copy production, the Patent Office is able to save space otherwise required for paper copy inventory and to improve its service to customers.

The fourth measure is use of a computer based documentation system for controlling patent documents.

A computer based record of patent documents relating to the same invention is maintained for use in screening items received from foreign countries to facilitate selection of documents for search files and in classifying and routing them. The flow of paper is materially abated with related savings in file space, and many man-hours of valuable time are freed from paper handling.

The fifth measure is commercial documentation services.

A growing number of information service companies are recognizing opportunities for rendering assistance in the patent field. To many users, the services offered by such companies seem to afford a means for bringing the information flood partially under control. Patent offices, too, are taking a close look at the services these sources

Table III. Machine Assisted Search Systems for Chemical Art

Art Area	Origin	Number of Documents
Status: OPERATIONAL		
1. Mold Compositions	In-House	2,000
2. Abrasives	In-House	700
3. Synthetic Fibers	In-House	700
4. Medicines and Poisons	In-House	48,000
5. Chemistry, Wave Energy Treatment ^a	In-House	2,500
6. Electrically Conductive or Emissive Compositions	In-House	2,500
7. Steroids ^a	In-House & ICIREPAT	9,600
8. Organometallics	In-House & ICIREPAT	5,500
Status: DEVELOPED, BUT NOT YET OPERATIONAL		
9. Alloys	ICIREPAT	27,200
10. Layered Products	ICIREPAT	27,500
11. Lubricants	ICIREPAT	21,000
Status: UNDER DEVELOPMENT		
12. Azo Dye	In-House	5,200
13. Ceramics	In-House & ICIREPAT	500 ^b
14. Inorganic Chemistry	In-House	^b
15. Foods or Edible Materials	In-House	^b
Status: DORMANT		
16. Phosphorus Compounds	In-House	3,270
		Total 156,170

^a Operational, but under revision. ^b Data not available.

offer to meet some of the older problems, as well as the new ones.

The sixth measure is development of machine assisted search systems.

Considerable effort has been expended in attempts to devise systems which would enable patent examiners to achieve the results of novelty search by faster, cheaper, and more effective means than by the process of scanning collections of documents in classified files. This effort goes on today and no doubt will continue and intensify until widely successful. Reports of projects conducted within the U.S. Patent Office as well as by many foreign patent offices have been well publicized in journal literature and the proceedings of the annual meeting of ICIREPAT. A number of them are in operational use in the U.S. Patent Office today, or soon will be. They are as shown in Table III.