for the U. S. Department of Agriculture to publish a notice in the Federal Register of the cancellation of the registration of many products containing heptachlor and to notify all individual registrants involved.

Prior to publishing this notice, the Pesticides Regulation Division requested the Data Processing Division to furnish a listing of heptachlor registrants so that they could be informed of the actions being taken and provided with the necessary instructions to bring their products into full compliance with the Act.

While this IR system has been useful for such purposes mentioned, there are certain limitations and a need for revisions to increase versatility. For example, one number is used to designate all surfactants in pesticide formulations unless the surfactant is considered as an active ingredient. The number assigned to pesticide uses on tobacco is also assigned to "other field crops." Also the inert ingredients in a pesticide formulation are not coded, so under these circumstances it is not possible to determine promptly through this system the extent to which certain inert ingredients occur in the thousands of products that have been registered.

In our pharmacology staff there appears to be a need to set up an independent IR system to handle the increasing quantity of pharmacological, toxicological, and biochemical information that is rapidly accumulating.

There are three distinct areas of information which must be related to each other in review of safety. First, the toxicity evaluations must be recorded in such a manner as to be readily available for frequent review. Secondly, the toxicity must be related to patterns of use. Finally, there is a need for accurate files with regard to necessary precautionary labeling for the chemical to be effective as an IR system. All of these areas of information must be integrated in such a manner as to make it possible for review within this office. It should be rapid and efficient for the handling of several hundred actions a week. In view of the fact that other Federal groups will be assisting us in the review of pesticide products with particular reference to safety, it becomes rather important that all liaison groups use the same IR system. We are still studying available retrieval systems to determine their adaptability to our needs.

## SUMMARY

A favorable decision on any application for the registration of a pesticide under the FIFRA cannot be given in the absence of adequate information to show that the pesticide can be used safely and effectively. Major problems in determining what constitutes adequate information exist. Serious problems also exist in informing prospective registrants on the type of data required and finally, the storage and recovery of accumulated information for subsequent use in the registration and enforcement programs is essential to effective operations of the Division.

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# The Patent Literature as an Information Source for Pesticide Chemists*

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## INTRODUCTION

United States Patents issued from January 1, 1950, through December 31, 1963, and which bear on the general subject of pesticides were examined as a source of useful information for the practicing chemist. During the 14-year period, there were issued 128,134 chemical and chemically related patents which have been systematically indexed in the UNITERM INDEX TO U. S. CHEMICAL PATENTS. The data used in this paper were obtained by a computerized search of the INDEX (P. W. Howerton, "Computerized Search of the U. S. Chemical Patent Literature," in "Automation and Scientific Communication," H. P. Luhn, Ed., American Documentation Institute, 1963, p. 255).

To ensure best coverage of all pesticide patents, the following UNITERMS are subsumed under the general term "pesticide":

| | |
|---|---|
| --Anthelminthic, nematocide | --insecticide |
| --bactericide | --miticide |
| --biocide | --phytocide, herbicide |
| --fungicide | |

Because the INDEX is constructed from the language contained in the patents themselves, there is a certain amount of duplication between the subordinate terms and "pesticide." Furthermore, not all "pesticide" patents are

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so called. The following table indicates the number of patents found under each search term.

| Term | Patents issued 1/1/50–12/31/63 |
|---|---|
| Pesticide | 1082 |
| Anthelminthic, nematocide | 454 |
| Bactericide | 1276 |
| Biocide | 81 |
| Fungicide | 2622 |
| Insecticide | 2026 |
| Miticide | 567 |
| Phytocide, herbicide | 1218 |

As one indicator of the overlap between UNITERMS, of the 2026 insecticide patents, only 658 also used the term "pesticide" in the patents; of the 1082 so-called "pesticide" patents, 418 did not have the word "insecticide" in them. Another interesting generalization from the straight statistical count has to do with the proportion of the total number of chemical and chemically related patents which is represented by the fungicide patents—over 2%; the insecticide patents—over 1.5%; and bactericides, and phytocides—about 1% each.

**Chemical and Biological Information in Patents.**—What are the types of information of use to the pesticide chemist obtainable from the patents? There are two categories—chemical and biological information.

The chemical information has to do with new compositions of matter which have had bioassay and are either *disclosed or claimed.* Frequently a family of compounds has been synthesized and all subjected to testing as some form of pesticide. Only one member of the family has real utility. Valuable data on the biological activity of both a positive and negative nature are to be found in the disclosure part of the patent. The relationship of biological activity to chemical composition, or even steric orientation, has not been clearly defined except in limited classes of compounds and organisms.

Other chemical information of value may have to do with the synthesis methodology, *i.e.*, reaction mechanisms to give steric isomers, catalysts, intermediates which might be subject to other secondary reactions not anticipated by the patentee, reaction conditions, etc. Still other information not easily found elsewhere may be unnamed compounds of a series. The individual disclosed or claimed compounds are found by generic search, *e.g.*, phosphorothioic acid esters, associated with insecticidal properties.

Carriers and stabilizers which have found uitlity in "pesticide" dispersion are the subjects of patents, *e.g.*, U. S. Patent 3,060,083 claims to stabilize a methyl parathion dust formulation with triethyl phosphate, acetal, methylbutynol, furfuryl alcohol, and mixtures thereof; U. S. Patent 3,060,084 suggests polyacrylic acid as an adjuvant to control the rheological properties of a water-insoluble pesticide such as Thiram; etc. To chemists who have synthesized a new pesticide but cannot disperse it, such information can lead them to a solution to their problem.

Testing methods for evaluating chemicals and formulations are usually described in some detail in the patents. Test organisms for the several types of "pesticide" are significant in comparative evaluation of new potential types of "pesticide" with those already patented. Persistence determinations compared with the standards established by use and approved by the U. S. Department of Agriculture and the Food and Drug Administration can give important leads as to the acceptability of a new formulation when compared with those disclosed in the patent literature.

**UNITERM Logic for Pesticide Searches.**—Let us look at a few concrete examples of how the pesticide chemist might use the UNITERM INDEX TO U. S. CHEMICAL PATENTS to search out patents of interest to him. The illustrations that follow were developed from the 1963 edition of the INDEX, in which 12,270 chemical and chemically related patents were covered.

If we postulate a question of a generic nature, such as all patents dealing with organic phosphorus compounds used as insecticides, we would find 61 patents. When the search is now narrowed to organic phosphorus compounds used specifically to kill flies, we find only ten pertinent patents. Cockroaches are mentioned in four organic phosphorus insecticide patents.

Now we might search for patents dealing with some specific organic phosphorus compounds in conjunction with insecticidal properties. The derivatives of phosphorothioic acid could be our case-in-point. In 1963, 26 patents mentioned phosphorothioic acid or phosphorothioates of which eight were of interest to our insecticide search. The other 18 patents covered lubricant and rubber additives and were of no interest to the search. Likewise, if phosphorodithioic acid derivatives are linked with insecticides, we found that 10 to 23 patents mentioning the phosphorodithioates had to do with insecticides. Two of the nonpertinent patents described anthelminthics and therefore did not fall out. If anthelminthics and phosphorodithioates were of interest, these two patents would have been found by matching these two UNITERMS.

Becoming even more specific, a search to determine whether S-(carbamoylalkyl)-O,O-dialkylphosphorodithioates had been patented and insecticidal properties claimed would immediately identify U. S. Patent 3,092,541 as a generic to the composition of matter. This same patent was indexed under phosphorodithioic acid, insecticide, and organic phosphorus compounds among 36 other index entries.

Turning for the moment to the patents concerned with the killing of flies, a conjunctive search using the UNITERMS "fly" and "insecticide" discloses 16 patents. In addition to the 10 organic phosphorus fly killers, there is one dealing with carbamic acid esters of phenols, one covering certain chlorinated conjugated alkadienic derivatives of an alkylated aromatic compound (3,102,143), an insect repellent-insecticidal composition, an inclusion body-forming and spore-forming *Bacillus* which is an active pesticide (3,087,865), etc.

The illustrations above have been relatively straightforward conjunctions of generic terms with varying degrees of specific terms. Another way that general searches may be made is to use the mechanized version of the UNITERM INDEX TO U. S. CHEMICAL PATENTS, and place in disjunction all the subordinate species of the pesticide series and relate them all to one general or specific composition of matter. For example, if a question were at issue of all forms of pesticides which contain organic phosphorus compounds, the question would be stated using the UNITERMS mentioned at the beginning of this paper in

disjunction, *i.e.*, pesticide or anthelminthic or bactericide or biocide or fungicide or insecticide or miticide or herbicide, and organic phosphorus compounds. A patent would be identified if any one of the utility terms and organic phosphorus compounds were mentioned.

The use of pyrethrins as synergists in insecticidal compositions to be used against mosquitoes was described in U. S. Patent 3,101,296 which was identified by matching the pyrethrins, synergist, insecticide, and mosquito.

Of course, the searching for specific compositions of matter to be used as a specific pesticide other than insecticide is carried out in the same manner as described above, *i.e.*, by associating the terms which seem to bear directly on the problem. If the search is made with the mechanized version of the UNITERM INDEX TO U. S. CHEMICAL PATENTS, after the patents complying with the search terminology have been found, one may perform a reverse search and ask the system to print out all the terms used to index each patent. This facility will suggest new search terms or reveal other disclosed compounds or actions which may bear on the project which stimulated the original search.

## CONCLUSION

In summary, patents constitute the most compact and easily identifiable technical literature resource available in which cause and effect are shown with a minimum verbiage. The U. S. Patents concerned with any subject associated with pest control can be of use to the practicing chemist who synthesizes new materials and to the biologist or phytologist who must evaluate them. The compatibility of agents and adjuvants or carriers is frequently revealed only in the pertinent patents and does not get into the usual journal literature.

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# Transcription of Technical Information*

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One step in the documentation process is so down-to-earth that little space has been devoted to it in the published literature. This step, "technical transcription," is performed by secretaries and stenographers. Since all written technical information must be typed at least once, typists must be able to handle complex technical terminology if this work is to be smooth and efficient.

At the Chemstrand Research Center, typists receive technical material from the originator by way of oral dictation or dictaphone belts about one-third of the time. For the remainder, typists are confronted with handwritten drafts which, more often than not, are relatively difficult to read. Experience has shown that typists must be able to recognize and to transcribe either spoken or poorly written technical information over half of the total time they spend on transcription.

While this problem had long been recognized at Chemstrand, until recently no determined effort had been made to solve it. As an experiment, therefore, Chemstrand's Technical Information Section planned and presented a course for typists who deal with technical information designed to increase their knowledge of and interest in the fundamentals and terminology of those technical fields of particular interest to Chemstrand—namely, general chemistry, polymers, and textile fibers. Since the course was well received, and since the response to a questionnaire indicated that the course was successful in helping typists handle technical information, its general and specific aspects are reported here.

## GENERAL

The course consisted of ten weekly sessions of one hour each. A total of 21 typists attended regularly. The general approach was to study the fundamentals and terminology of a specific field of interest, then to conduct practice sessions in dictation until most of the class members had mastered the terminology in that area. Usually, the technical terms were selected from the thesaurus which is used in indexing Chemstrand's reports. Time was also spent on drilling in the handling of chemical equations.

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