

Development of a Unified Reference System for a Multi-personnel Research Group

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The establishment of a reference filing system, based on optical coincidence retrieval, for an eight-man research group studying gas reactions is described. The complete system is simple to use and gives rapid, precise reference retrieval.

A simple system for the storage of references to useful information together with a method of rapid retrieval of such information when required is a necessity for any research enterprise. The requirement for a unified system is particularly acute for the modern research group in which several individuals with overlapping and complementary interests combine. Any system used must take into account the complexity of several fields of study, must be capable of expansion to accommodate the changing interests of the users, and must be easily operated and comprehended by the individual members of the group.

This paper describes the experience gained in establishing such a system based on optical coincidence retrieval, for a group of some eight personnel studying fast gas phase reactions. In addition to the complexities of this particular topic, the system chosen also had to accommodate the interests of one of the members as editor of a series devoted to dynamic mass spectrometry.

DESCRIPTION OF SYSTEM

Assorted individual 6×4 inch card file systems had previously been used by members of the group, the cards being filed according to first author and subject. This system, while adequate for a small total number of cards—e.g., as would be required by the average Ph.D. student—becomes very unmanageable as the total number increases above a few hundred. Main primary authors are not necessarily the first author of any reference, frequently more than one subject card must be made out for a single reference, and the retrieval rate decreases rapidly as the system grows.

When it was decided to combine and standardize the reference filing of the whole group, the choice was made between either edge-notched¹ or optical coincidence cards. Edge-notched cards are normally large enough for an abstract of the particular reference. This system can expand only as much as the numbers around the edge permit. Once these have been allocated, then another set of cards must be commenced to enlarge the system. Cross-referencing between two or more sets of cards is time consuming. The optical coincidence system can be expanded indefinitely. Since an expandable system was considered essential for this research group, which has changing interests and personnel, it was decided to reject the edge-

notched system and to choose a system of optical coincidence cards.

Optical coincidence cards (OC cards) are available (J. L. Jolley and Partners, Westbourne House, Westbourne St., High Wycombe, Bucks.) from about 2500 to 10,000 number capacity, the one chosen by the authors being 5500. Each of these OC cards is divided into 5500 small sequentially numbered squares each of which corresponds to a 6×4 inch master card (Figure 1) which gives full details—i.e., title, authors, location, keywords, and any essential notes—of a particular reference in the system. Each OC card corresponds to either the initial letter of an author surname or a keyword in the thesaurus of the group's interest. The number of each master card corresponding to the author initial or keyword of a particular OC card is punched out on that OC card; the punching is performed using a simple manual punch constructed in the departmental workshops. Thus each OC card gives at a glance a general picture of the amount of reference material filed on a particular topic as well as the numbers of the master cards appertaining to the topic. If a combination of several topics is to be searched, then the appropriate OC cards are held together. Light shines through where punched out holes coincide—the numbers of the coincident holes correspond to the master cards with the required combination of keywords. For example, if one required reviews of mass spectrometers, then one takes the OC cards for REVIEWS and MASS SPECTROMETERS and holds them together up to the light. This method is suitable for a small number of OC cards. For larger num-

0286	DETECTION OF ATOMS AND FREE RADICALS BY MASS SPECTROMETRIC TECHNIQUES	
	S. N. Foner and R. L. Hudson, J. Chem. Phys., <u>21</u> , 1374, (1953).	
	REPRINT	Mass Spec.
	Calcn.	Mol. Beam Sampling
	C ₁ C ₂	Phase Sensitive Detection
	O H	Free Radical
	Exptl.	Atom
		Flames
		Sector Instr.
		Sensitivity

Figure 1. Typical 6×4 inch master card

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ber—e.g., six or more—the cards are easily searched by placing them on top of a suitable light box. The OC cards are provided with suitable edge-notches to ensure correct alignment during the search process. In the experience of the authors, the greater the combination of keywords searched, the more rapid is the rate at which the appropriate references are retrieved.

The method adopted for collecting data for punching the OC cards is to read the original reference, abstracting the required information onto the master card. At the end of each session, the numbers of the master cards are transferred to the appropriate columns headed by the thesaurus keywords and author initials. The OC cards are punched when a reasonable number of references have been abstracted. If the wrong hole is punched then the space should somehow be filled in—e.g., by sellotape: which is a disadvantage—or the whole OC card repunched. Our experience of ignoring the odd mis-punched hole has been that the inconvenience thus caused is negligible.

The system in use is divided into four parts: the thesaurus, the OC cards, master reference cards and, when appropriate, reprints of the reference. The reprints are given the same number as the corresponding master card and are filed accordingly. When a copy of a reference is on file this is noted by writing REPRINT on the master reference card.

ESTABLISHMENT OF THESAURUS

Having selected the optical coincidence system it was then necessary to compile a comprehensive thesaurus to cover the topics of Mass Spectrometry and Gas Kinetics. The first approach was to examine a computer profile based on the UKCIS Chemical Titles service previously used by the group. (A current awareness service based on computer searching of *Chemical Titles*; United Kingdom Chemical Information Service, The University, Nottingham N97 2RD.) There had been problems when this profile had been compiled due to nonspecific terms—e.g., free radical, mass spectrometry—frequently used in the titles of publications. The profile relied on negative terms, journal citations, and, to a certain extent, author citations, to improve its recall precision. Obviously these problems arose because of the large data base used for *Chemical Titles*, the profile being designed to give broad coverage to ensure high recall of relevant publications. This resulted in low precision, less than 10% of the output being useful. Since only relevant references are entered into the filing system, it was necessary to consider more specific terms—e.g., methyl radical—for the thesaurus to give low recall and high precision. It was, therefore, decided to ignore the UKCIS profile, and the thesaurus was compiled in the following manner. The indexes to two key textbooks, "Gas Kinetics" by Pratt, G. L., Wiley, 1969, and "Chemical Kinetics" by Laidler, K. J., McGraw-Hill, 1965, were examined and relevant terms extracted, put on cards, and arranged in alphabetical order. Finally, some two hundred of the group's key references were selected, and the important words in their titles and contents were added, likewise on cards, to the collection. Duplicates and terms which were too general—e.g., gas reaction—were

discarded. Since this group is interested in gas kinetics it could be assumed that all references were to gas reactions unless cited for liquid or solid phases. The remaining keywords were typed out onto a sheet of paper and examined for synonyms. The latter were eliminated by choosing a main word as a *USED FOR* term. This was typed in capital letters—

e.g., CHAIN REACTION *USED FOR*

Branching chain

Chain length

Chain mechanism

Its synonyms are called *USE* terms, and are typed as small letters—

e.g., Chain mechanism *use* CHAIN REACTIONS

The thesaurus compiled is divided into four sections:

1. **Generalia.** This is to cover general points which are not actually subject headings in the field of gas kinetics and mass spectrometry—but are of general importance,

e.g., Books, reviews, calculation, etc.

2. **Authors.** All authors (not only the first one) are entered on the index by the first letter of their surname. This ensures that all references to a particular author are retrievable. It frequently happens that a certain author writes on a topic with others and yet is never the first author. In the conventional card index filed by first author only, location of all the work of one man proves to be very difficult unless the system has added *see* references for all secondary authors. Indexing of all authors is an advantage in this respect.

Obviously, for common letters like M or S a certain amount of false references will appear; but if the cross reference subjects are chosen carefully, the number is kept fairly small. Speed of accurate retrieval increases greatly when there are three or more authors on the required paper.

3. **Chemical Formulas.** This section includes elements and chemical groups relevant to the research for which the system is devised.

4. **Subject Headings.** The main listing of subjects amounting to 117 headings. Those terms which prove to be of little use can be eliminated from time to time by reference to the OC cards which give at a glance the amount of material on each topic.

CONCLUSION

The system established gives rapid and precise information retrieval, the speed and precision increasing with the number of terms cross-referenced. For example, a colleague claims he can search 10,000 edge-notched cards in about an hour. Our experience indicates that the OC card system would reduce that search time by at least a factor of ten. The system was no more trouble than an edge-notched system to establish. Since the hole-punch and the light box were available in the department, the sole cost was that of the cards.

LITERATURE CITED

- (1) Bottle, R. T., "The Use of the Chemical Literature," 2nd ed., p. 76, Butterworths, London, 1969.