

# KEYWORD-IN-CONTEXT INDEX FOR TECHNICAL LITERATURE

(KWIC INDEX)\*

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## ABSTRACT

A distinction is made between bibliographical indexes for new and past literature based on the willingness of the user to trade perfection for currency. Indexes giving keywords in their context are proposed as suitable for disseminating new information. These can be entirely machine-generated and hence kept up-to-date with the current literature. A compatible coding scheme to identify the indexed documents is also proposed. In it elements are automatically extracted from the usual identifiers of the document so that the coded identifier yields a maximum of information while remaining susceptible to normal methods of ordering.

## INTRODUCTION

Specialized indexes to technical literature are an established means for directing engineers and scientists to sources of information pertinent to their current interest. Whatever the specific purpose of an index may be, a substantial amount of intellectual effort is required to compile it. In many cases, the time required for compiling and updating an index interferes seriously with its usefulness at the instant of publication. This is particularly true of bibliographical indexes to material currently being published in such media as technical journals, magazines or technical governmental, institutional and private industry reports.

The accelerated pace of scientific developments in recent years has accentuated the perishable nature of new information. As a result there is a pressing demand for speedier communication in science. One may doubt that this demand can be satisfied without breaking with some of the standards conventionally applied to the compilation of literature indexes.

In the discussion that follows the relationship between user and index is examined, and it is shown that for new information, which, as it appears, is only a fraction of the total information accumulated in an area, relatively rough clues can answer the user's needs. It is therefore argued that such clues can be generated

entirely by machine, in the form of a series of extractions each containing a significant, or key, word as its nucleus. Samples of indexes compiled entirely by machine methods are presented in support of this argument.

## DISSEMINATION vs. RETRIEVAL

In the area of communication served by technical literature, the two main functions performed are the dissemination of information and the retrieval of information. A publication, when issued, serves to broadcast new information. After the publication has fulfilled this purpose and has been retired to the library and properly stored, it serves as a potential source in the process of information retrieval. In the first instance its news aspect is predominant, and in the second its historical aspect is predominant.

The argument here presented is that by means of a relatively few clues an expert can judge whether an article touches his field of interest and he can adjust himself momentarily to whatever new information may or may not be furnished by the item in question. In the case of information retrieval the same scientist expects that the information furnished will be adjusted to his needs, i.e., to his rather specific interest at the moment.

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Because of the difference in attitude in these two cases it is here proposed to consider two types of indexes, namely a dissemination index and a retrieval index, each fulfilling its respective functions and differing in scope and form. A dissemination index, then, would be an instrument prepared with minimum effort and disseminated in the shortest possible time. As such it would fulfill the important task of prompt notification, and its usefulness would be substantially temporary in character. For this reason its publication by inexpensive printing methods would appear justifiable and adequate. A retrieval index, on the other hand, would be an instrument prepared with care, and incorporating all those features which will enhance its usefulness as a permanent tool of reference. Probably it would take the form of a cumulative index and would make obsolete dissemination indexes previously issued for material included in it.

#### INDEXING BY MEANS OF KEYWORDS IN CONTEXT

The usefulness of an index depends on the manner in which its entries have been organized. The establishment of categories by subject, or other appropriate characteristics, is the conventional means by which such organization is accomplished. The establishment of categories and the assignment to such categories of index entries is a matter of judgment and experience and constitutes a considerable part of the intellectual effort involved in the manual compilation of indexes. Indexers will usually differ in their approaches to this task and will differ also in their interpretation of the material to be indexed. While there may be differences of opinion as to the effectiveness of this or that scheme, the important fact seems to be that any reasonable scheme of ordering, if understood, will save time in locating information.

In selecting a speedy method of organizing an index, the question arises as to which of various possible schemes is adaptable to fully automatic processing. Clearly, some means of ordering is required that is based on criteria extracted from the text itself rather than assigned in accordance with human judgment.

The simplest form of a quickly assembled index might be an alphabetic listing of keywords, very much as in the index to a book.

The simplicity of such an index is, however, predicated on the fact that the reader has been introduced to the subject matter treated by the book. In dealing with a variety of subjects, as would be the case in the problem under discussion, the significance of such single keywords could, in most instances, be determined only by referring to the statement from which the keyword had been chosen. This somewhat tedious procedure may be alleviated to a significant degree by listing selected keywords together with surrounding words that act as modifiers pointing up the more specific sense in which a keyword has been applied. This method of indexing words is well established in the process of compiling concordances of literary works. The added degree of information conveyed by such keyword-in-context indexes, or "KWIC Indexes" for short, can readily be provided by automatic processing.

Keyword-in-context indexing may be performed on various levels, depending on the purpose an index is to serve. The process may be applied to the title of an article, its abstract, or its entire text. Keywords need only be defined as those which characterize a subject more than others. To derive them, rules have to be established for differentiating that which is significant from the non-significant. Since significance is difficult to predict, it is more practicable to isolate it by rejecting all obviously non-significant or "common" words, with the risk of admitting certain words of questionable value. Such words may subsequently be eliminated or tolerated as "noise". A list of non-significant words would include articles, conjunctions, prepositions, auxiliary verbs, certain adjectives, and words such as "report", "analysis", "theory" and the like. It would become the task of an editor to extend this list as required. The remaining significant or "key" words would be extracted from the text together with a certain number of words that precede and follow. By making the keywords assume a fixed position within the extracted portions and by arranging these portions in the alphabetic order of the keywords, the KWIC Index is generated.

The format of a KWIC Index is illustrated in Fig. 1. The initial letters of the alphabetized keywords form a column which guides the eye when scanning for desired words. The number to the right of each line identifies the corresponding document. The sample shown in Fig. 1 was derived from titles of technical papers.

Since a title may contain several keywords index entries would appear in as many places as there are keywords. For example, on the sample page the concept "Gamma Rays in Ge 72", will be found under "Gamma" and under "Ge".

A maximum of 60 characters of a title are printed to serve as the index entry. This provides for an adequate number of letters on either side of the keyword by including immediately associated significant words. The proc-

#### KEYWORD-IN-CONTEXT BIBLIOGRAPHICAL INDEX

COULOMB EXCHANGE ENERGY FROM SHELL-MODEL WAV  
EXCITATION OF PROTONS IN HELIUM II R  
OF ATOMIC AND MOLECULAR EXCITATION BY A TRAPPED-ELECTRON ME  
THERMAL EXCITATIONS IN LIQUID HE<sub>3</sub>  
ENERGIES OF GROUND AND EXCITED STATES OF VSI AND CR53.  
4-PLUS EXCITED STATE IN OSMIUM-186  
INTERNAL PHOTOEFFECT AND EXCITON DIFFUSION IN CADMIUM AND ZIN  
OF THE CONTRIBUTION OF EXCITONS TO THE COMPLEX DIELECTRIC  
THERMAL EXPANSION OF SOME CRYSTALS WITH THE  
ENERGY LEVELS IN P18 FROM THE N14/ALPHA, ALPHA/N14 AND  
ON FROM AL27-PLUS-P AND F19-PLUS-P.  
TIC MEASUREMENTS OF THE FE-60 SPINELS.  
BARIUM FERRITE III.  
MAGNETOSTATIC MODES IN FERROMAGNETIC SPHERES.  
NICKEL-IRON FERRITE.  
TRANSITION TO THE FERROELECTRIC STATE IN BARIUM TITANA  
SUPERCONDUCTIVITY AND FERROMAGNETISM IN ISOMORPHOUS COMPOU  
INTERPLANETARY MAGNETIC FIELD AND ITS CONTROL OF COSMIC-RAY  
MAGNETIC FIELD DEPENDENCE OF ULTRASONIC ATTEN  
RELATIVISTIC FIELD THEORY OF UNSTABLE PARTICLES.  
QUANTUM FIELD THEORIES WITH COMPOSITE PARTIC  
FIELD THEORY.  
A GENERALLY INVARIANT FIELD-INDUCED CHANGES IN SURFACE REC  
AND SURFACE STATES FROM FISSON INDUCED BY ALPHA PARTICLES.  
ANGULAR DISTRIBUTIONS IN FISSONABLE NUCLEI.  
UTRON CROSS SECTIONS OF FLUCTUATIONS OBSERVED AT SOUTHERN ST  
AL COSMIC-RAY INTENSITY ELUX OF COSMIC-RAY PARTICLES WITH Z-  
NEUTRINO CORRELATION IN FORBIDDEN BETA DECAY.  
RVATION IN THE DECAY OF FOURIER COEFFICIENTS OF CRYSTAL POTE  
STEADY-STATE FREE AND BOUND LAMBDA PARTICLES.  
DECAY OF FREE PRECESSION IN NUCLEAR MAGNETIC  
GADOLINIUM-159. FREQUENCY SHIFT OF THE ZERO-FIELD HY  
GAMMA RADIATION FROM AL27-PLUS-P AND  
GAMMA RAYS IN GE72.  
CISION DETERMINATION OF GAMMA RAYS FOLLOWING P-P-PRIME-GAMMA  
P/532 AND 532/P-P-PRIME GAMMA/532.  
ONSTANT OF YTTRIUM IRON GARNET AT 0 DEG K.  
LORENTZIAN GAS AND HOT ELECTRONS.  
TIBILITY OF AN ELECTRON GAS AT HIGH DENSITY.  
CTIVITY OF AN ELECTRON GAS IN A GASEOUS PLASMA.  
OF AN ELECTRON GAS IN A GASEOUS PLASMA.  
DUCED BY VARIOUS BUFFER GASES.  
IONIZED GAS.  
EZORESISTANCE IN N-TYPE GAAS.  
IN ELECTRON-IRRADIATED GE AT 80 DEG K.  
LATION OF GAMMA RAYS IN GE72.  
HERAL RELATIVITY AS THE GENERATORS OF COORDINATE TRANSFORMAT  
ETORESISTANCE IN N-TYPE GERMANIUM AT LOW TEMPERATURES.  
CONDUCTION ELECTRONS IN GERMANIUM.  
IATIVE RECOMBINATION IN GERMANIUM.  
PARTICLES IN LINEARIZED GRAVITATIONAL THEORY.  
ENERGIES OF GROUND AND EXCITED NUCLEAR CONFIGURA  
KINEMATICS OF GROUND STATE OF TWO-ELECTRON ATOMS.  
RIC CONSTANTS OF HALIDE CRYSTALS.  
TWO HALL EFFECTS OF IRON-COBALT ALLOYS.  
HALL MOBILITY OF CARRIERS IN IMPURE  
HARD SPHERES. I. EQUILIBRIUM PROPERTY  
OLUME ANCHALY OF LIQUID HE<sub>3</sub> ARISING FROM ITS NUCLEAR SPIN SY  
L EXCITATIONS IN LIQUID HE<sub>3</sub>.  
OF 95-MEV PROTONS WITH HE<sub>4</sub>.  
TION OF DONOR STATES IN HEAT-TREATED SILICON.  
UCLEAR ENERGY LEVELS IN HEAVY ELEMENTS.  
XCITATION OF PROTONS IN HELIUM II BY COLD NEUTRONS.  
MAGNETIC MOMENT OF HELIUM IN ITS 3S1 METASTABLE STATE.  
LITY OF LI-PLUS IONS IN HELIUM.  
OF SN, IN, TA, TL, AND HG.  
ISOMERS IN T158 AND H0163.  
LORENTZIAN GAS AND HOT ELECTRONS.  
ICROWAVE PROPAGATION IN HOT MAGNETO-PLASMAS.  
OF THE ELECTRON ON THE HYDROGEN ENERGY LEVELS.  
DISSOCIATION OF THE HYDROGEN MOLECULE ION BY ELECTRON IM  
SS OF SLOW ELECTRONS IN HYDROGEN.  
HYDROMAGNETIC EQUATIONS FOR TWO ISOT  
HYPERFINE SPLITTING OF CS133 PRODUCE  
HYPERFINE ABSORPTION LINES OF CS133  
HYPERFINE-STRUCTURE SEPARATIONS AND  
MASSES OF CHARGED SIGMA HYPERONS AND THE NEGATIVE K MESON.

1719  
0011  
0150  
1465  
0452  
1491  
1717  
0123  
1555  
0136  
0547  
0239  
1603  
0326  
0059  
0397  
0413  
0089  
0589  
0080  
0283  
0669  
1826  
0369  
0536  
0203  
1798  
0597  
0244  
0073  
0405  
1493  
0449  
0262  
0239  
0229  
0532  
0051  
1702  
0395  
1567  
0328  
0001  
0001  
0449  
0450  
1441  
1533  
0362  
0229  
0287  
0317  
0298  
0330  
0674  
0452  
1649  
1488  
0090  
0381  
1516  
0044  
1419  
1483  
1465  
1658  
0049  
1546  
0818  
0011  
1627  
0645  
0031  
0489  
1567  
1460  
1637  
0155  
0159  
1441  
0449  
0450  
0186  
0622

cess of slicing a fixed number of letters out of a title necessitates mutilations of some words at either end of the resulting fragment.

#### ORGANIZATION OF A BIBLIOGRAPHICAL KWIC INDEX

As is evident from the preceding explanation, the grouping of a given set of bibliographic items into subject categories is eliminated and is replaced by a grouping according to keywords. This arrangement overcomes all arguments as to the appropriateness of assignment of certain items to pre-established subject headings and abolishes the nondescript category of "Miscellaneous". If the index is based on titles of documents, its quality depends on how well the authors have composed the titles of their papers. Experience will indicate whether KWIC indexing needs to be extended to include abstracts, or even portions of the text, to provide the degree of resolution required.

One of the problems a user of a KWIC Index faces is that of synonyms and variations in word usage and spelling. One must however assume that the expert is sufficiently familiar with such variations in his field and is resourceful in overcoming this problem, as he has had to in the past. It is of course quite simple to insert at appropriate places in the index a "see also" reference to provide for the less obvious instances. This convenience does not call for additional intellectual effort on the part of the editors once the need for such a reference has been established. Thereafter the insertion of such references will be automatically provided by the machine.

The type of bibliography here proposed would necessarily consist of two parts: a listing of the bibliographic items and the KWIC Index. The items would be listed in alphabetic order of authors' names and comprise author, title, and source data. This list would thus serve as an author index.

Since each KWIC Index entry must be related to the relevant bibliographic items, there arises a problem of identification. A simple means of identification would be the use of serial numbers assigned to the bibliographic items listed alphabetically by author. These numbers would be given after each index entry (see Fig. 1) and would refer the user to the corresponding item in the bibliography. Such reference numbers are limited to the function

Figure 1

just mentioned and would serve no useful purpose beyond the bibliography to which they have been applied.

One of the principal advantages resulting from the type of indexes here proposed is the promptness, because of their machine origin, with which they can be disseminated. It would therefore be feasible to issue KWIC Indexes at frequent intervals, perhaps monthly. While this would fulfill the demand for currency, the subscriber to such a service would soon be inconvenienced by having to handle a multiplicity of individual issues. To facilitate bibliographic search from the time it is published until it is noted in some more refined reference manual, the KWIC Indexes might be cumulated. Since they are to be produced automatically, the effort and cost of providing this extra convenience is quite moderate.

The creation of cumulative KWIC Indexes necessitates the renumbering of previously listed items and of their related index entries. To eliminate this possible confusion, a novel type of identification code may be used which remains unchanged, and yet permits the insertion of new items in a previous list while maintaining sequential order. This identification code will be described in some detail.

#### A DERIVED CODE FOR THE IDENTIFICATION OF BIBLIOGRAPHICAL ITEMS

This code is derived from factual data inherent in a document as evinced by the publisher's printed identification, comprising the following elements:

1. The name of the author (or senior author) or originating agency.
2. The year of publication.
3. The title of the document.

The objective is to derive unique notations for these with a reasonably low probability of duplication. A further objective is to produce a notation which conveys intelligible information and thus enhances its usefulness.

The code comprises eleven character positions. The first six are derived from the name of the author or originating agency, the next two consist of the ten's and unit digit of the year of publication, and the last three are derived from the title.

The rules for deriving the first six letters

of the code do not distinguish between names of authors and originating agencies, but apply to whatever words or letters follow each other in spelling such names. It is, however, required that such names be separated from subsequent information by a two-space interval and that an author be identified by recording his surname first. If an author's given names are represented by initials only, these initials should either be written without space between them, or each initial should be followed by a period. Punctuation marks and special characters are not a part of the code. The following 16 words are disregarded except when followed by a period or at least two spaces:

a, an, and, as, at, by, for, from  
if, in, of, on, or, the, to, with

This latter provision prevents the elimination of initials because of their possible similarity with the words here listed.

The formation of the code notation is carried out by entering the first four letters of the adjusted name into the first four positions of the code, irrespective of whether these letters are adjacent or separated. If the remaining portion of the name contains no additional words or letters separated by spaces, the 5th and 6th letters of the name, to the extent that they are present, are placed in positions 5 and 6 of the code. If one additional word remains, its two starting letters are placed in positions 5 and 6. If two or more additional words remain, the starting letters of the first two remaining words are placed in positions 5 and 6 respectively.

In applying these rules to an author's name, the first four letters of his surname become the first four letters of the code and the initials of the author's first and second given names will become the next two letters.

The rules for deriving the last 3 digits from the title, positions 9, 10 and 11 of the code, require that, as before, punctuation marks and special characters as well as any of the 16 words previously listed, be disregarded. The three code letters for the title are derived from the initial letters of the first three words of the adjusted title to the extent that they are present. These letters are placed in positions 9, 10 and 11 of the notation in the order in which the words appear in the title. Subsequent words, if any, are disregarded.

In accordance with the above rules the identification code for this article would read:

"LUHNHP59KCI". Other typical examples of bibliographic identification codes are given in Figure 2. The letters or numbers extracted to form the code have been underlined.

The above code format was chosen over other possible variations for the reason that when bibliographical entries are ordered in alphabetical sequence in accordance with this code, the utility of the resulting listing as an author index is not seriously impaired since the variations between this order and that demanded by the fully spelled names are slight.

The usefulness of a derived identification code for bibliographic items might extend beyond the present application. Such a code might very well solve some of the identification problems encountered in documentation as identical codes may be derived independently for the same documents. If desired, a self-checking feature may be incorporated in the code by adding an extra character with the aid of which a simple arithmetic test may be performed to ascertain correctness of spelling. Furthermore, the code may be amplified by the addition of source data, derived by methods similar to those used for authors, as explained above.

## AUTOMATIC PREPARATION OF KWIC INDEXES

The various steps involved in the automatic preparation of KWIC Indexes for technical lit-

### DERIVATION BY MACHINE OF 11-CHARACTER INDEX CODES FOR THE IDENTIFICATION OF BIBLIOGRAPHICAL ITEMS.

CCGOML-52-WMT	C, C, GOODRICH MEMORIAL LIBRARY WHY AND HOW THE TECHNICAL LIBRARY SHOULD BE SET UP AND UTILIZED IN CREATIVE ENGINEERING, MACHINE DESIGN SEPT 1922 PP. 111
HOLHJE-57-MDD	HOLMSTROM JE MULTILINGUAL DICTIONARIES AND DOCUMENTATION NACHRICHTEN DOKUMENTATION MAR. 1957
INSTAS-55-SST	INSTITUTE OF THE AERONAUTICAL SCIENCES SYMPOSIUM ON STANDARDIZATION IN TECHNICAL INFORMATION SERVICES FOR GOVERNMENT
JOHNHU-55-MIP	JOHNS HOPKINS UNIVERSITY MEDICAL INDEXING PROJECT, FINAL REPORT, WELCH MEDICAL LIBRARY, JOHNS HOPKINS UNIVERSITY MEDICAL INDEXING PROJECT, FINAL REPORT, 1922
KENTA-57-HSH	KENT A MACHINE SEARCHING OF METALLURGICAL LITERATURE, METAL PROGRESS, FEB. 1927
KINGGW-55-NAI	KING GW A NEW APPROACH TO INFORMATION STORAGE, CONTROL ENGINEERING AUGUST 1922
KOELGJ-58-PFM	KOELFELJUN GJ THE POSSIBILITIES OF FAR-REACHING MECHANIZATION OF NOVELTY SEARCH OF THE PATENT LITERATURE, PREPRINTS OF PAPERS FOR THE INTERNATIONAL CONFERENCE ON SCIENTIFIC INFORMATION WASH. DC 1922
MACCGE-54-CFS	MAC CASLAND GE A CONCISE FORM FOR SCIENTIFIC LITERATURE CITATIONS, SCIENCE 120, JULY 1924
NIDHRI-57-ERH	NIDQUEST RESEARCH INSTITUTE, KANSAS CITY, MO., ELECTRONIC BRAIN BULLS NEW CHEMICAL USES, CHEMICAL WEEK NOV. 23, 1927
NATLRS-57-SPE	NATL. BUR. OF STANDARDS WASHINGTON DC SYNTAX PATTERNS IN ENGLISH STUDIED BY ELECTRONIC COMPUTER, COMPUTERS AND AUTOMATION JULY 1927

Note: The letters or numbers extracted by the machine to form the code have been underlined.

Figure 2

erature will be described briefly and without tying them to any particular type of information processing equipment, except by way of example.

## Creation of Machine-Readable Record

Automatic processing requires that information be available in machine-readable form. Although print-reading devices might eventually translate printed characters into machinable codes, there are today many instances of machine-readable records being produced as a by-product of typing and typesetting operations. These are available in the form of punched tapes or cards and can readily serve as input to present information processing equipment.

In the case of technical literature, the typesetting of many professional journals and technical magazines is done on punched-tape controlled Monotype or Teletypesetter equipment. Flexowriters are often used for preparing technical reports in order to produce a punched tape for various subsequent retyping operations. In these instances no further manual operations are required to obtain the input for automatic processing.

When no such records are available, they must be prepared by hand. A most convenient method involves the preparation of punched cards by manual key-punching from the printed text of the portions needed for the process. These portions are the author, title, and source of the document if the KWIC Index is to be derived from titles only, otherwise the abstract or even the text would have to be hand-punched.

Limiting the description to titles only, the punching of cards would best be performed in accordance with certain rules which will facilitate machine processing, for the creation of the KWIC Index and many other useful records for facilitating various tasks of publishers, information centers, documentalists, and librarians.

These rules standardize the format of cards and the manner in which information is to be recorded. For example, it might be advantageous to prepare a separate card for each author and one or several cards each for the title and the source. The arrangement would be such that a listing of these cards by automatic printing devices would produce a bibliography of good appearance. Furthermore, the standardization of these card records will simplify the programming of information processing equipment for performing the routines necessary for

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U.S. PATENT OFFICE OF RESEARCH AND DEVELOPMENT
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COOPERATIVE INFORMATION PROCESSING - PATENTS.  
U.S. PATENT OFFICE OF RESEARCH AND DEVELOPMENT
- ANDROD- -ILA ANDREWS DD  
INTERRELATED LOGIC ACCUMULATING SCANNER.  
U.S. PATENT OFF.
- ANDROD- -LPO ANDREWS DD  
THE LAW AND PATENT OFFICE RESEARCH.  
U.S. PATENT OFFICE OF RESEARCH AND DEVELOPMENT
- ANDROD- -NFG ANDREWS DD  
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Figure 3

## Key Words-In-Context Index

- ENT AND PROOF SERVICES.  
URING COUNTRY, MACHINES  
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Figure 4

deriving identification codes and for extracting the index entries. As was mentioned before, the selection of keywords might best be carried out by rejecting insignificant words of the kind previously described. A dictionary of such words must therefore be compiled and revised in machine-readable form so that it may be transferred to the memory of the machine for reference during processing.

### Machine Processing

There is no intention here to go into the details of programming information-processing equipment, particularly since many different types of machines may be used to obtain similar results. Basically the following major functions need to be performed on each record fed into the machine.

First the identification code is derived. Each word of the title is then looked up in the dictionary of insignificant words stored in the machine. For each word not contained in the dictionary an index entry is generated by shifting the text of the title so that the word in question starts at position 25 of a 60 position field. The contents of this field is then stored together with the identifying code.

When this process has been repeated for each of the documents which are to constitute the bibliography, the records are sorted in the alphabetic order of their identification code and are printed in the form shown in Fig. 3. The index entries are then sorted in the alphabetic order of the keywords, and printed in a form similar to that shown in Fig. 4, with their identification codes at the right. Figs. 3 and 4<sup>1</sup> are typical pages of an index. One should note that the identification codes shown in these samples

have been derived by rules differing slightly from those described in the present paper.

The finished prints of the bibliography and the index are mounted in two columns of 125 lines each for photographic reduction to fit 8-1/2 x 11 size pages. The whole is then printed and bound and the KWIC Index is ready for mailing.

### CONCLUSION

To date only a few KWIC Index services have been installed and these are on an experimental basis. Though user acceptance has been very favorable, only experience will indicate the extent to which objectives of this new device can be realized.<sup>2</sup>

The following advantages are apparent at this time:

1. Because of the mechanical method of preparation, more information may be displayed than would have been practicable by conventional means.
2. Keywords-in-Context permit the cross-correlation of subjects to an extent not realizable by conventional procedures.
3. KWIC Indexes provide an invaluable basis for the compilation of reference material by professional catalogers and indexers.

One must keep in mind that machine products of the kind discussed here can never reach the level of perfection of which human beings are capable, and that there will always be residual effort left for human beings. One may hope that in the case of the KWIC Index this effort is acceptable to the user.

<sup>1</sup> From: "Bibliography and Auto-Index, Literature on Information Retrieval and Machine Translation," Service Bureau Corporation, New York, N.Y., Second Edition, June, 1959 (First Edition, Sept. 1958).

<sup>2</sup> The publication of *Chemical Titles*, recently announced, should go far toward testing the practicability of the KWIC Index technique. — Ed.