Table I. *Continued*

Example No., Reference, and *CA* Reference		Compounds and Molecular Formulas	Starting Material (S.M.) or Intermediate (I.)	Found in Formula Index
		Ethyl 3,4,5-trimethoxy-benzoylacetate, $C_{14}H_{18}O_6$	S.M.	No
11.	*Tetrahedron* 7, 130–7 (1959) *CA* **54**, 4681*c* (1960)	16 α-Cyano-3β-hydroxy-5-pregnen-20-one $C_{22}H_{31}NO_2$	I.	Yes
		16 α-Cyano-5-pregnene-3β,20β-diol $C_{22}H_{33}NO_2$	I.	Yes
		16β-Carboxy-5-pregnene-3β,20β-diol 16,20-lactone $C_{22}H_{32}O_3$	I.	Yes
		3β-Acetoxy-20β-hydroxy-5-pregnen-16β-carboxylic acid 16,20-lactone, $C_{24}H_{34}O_4$	I.	Yes
12.	*Tetrahedron* 5, 15–26 (1959) *CA* **53**, 14144*g* (1959)	Δ^4-Pregnene-3β,20β,21-triol-21-monoacetate $C_{23}H_{36}O_4$	I.	Yes
		Δ^4-Pregnene-3β, 21-diol-20-one diacetate, $C_{25}H_{36}O_5$	I.	Yes

Table II. Number of Selected Starting Materials and Intermediates

	From Original Journal Articles	From Original U. S. Patents	Total
Number of compounds	25	12	37
Number of starting materials	6	7	13
Number of intermediates	19	5	24
Number of starting materials found in formula index	4	2	6
Number of intermediates found in formula index	19	2	21

FUTURE PLANS

An attempt will be made to obtain financial support for a more definitive and statistically significant study of formula indexing procedures, especially for the years 1962 to 1968.

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Literature Retrieval in the Aluminum Industry*

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A review of the major sources of information pertinent to the aluminum industry, with emphasis on *Chemical Abstracts* and the *ASM Review of Metal Literature*. An evaluation is made of these sources, including coverage and indexing.

The objective of this paper is to serve as a guide to the literature of the aluminum industry.

The sources evaluated include *Chemical Abstracts, ASM Review of Metal Literature, Official Gazette of the U.S. Patent Office, Uniterm Index of Chemical Patents, Engineering Index, Electrical Engineering Abstracts, Metals Abstracts, Aluminum Technical Information Service,* and *Aluminum Abstracts.* Most of the paper is devoted to the first two, as they are the major sources for a retrospective search. Some mention should be made here of the U.S. Government sources, but these are in turn searched and abstracted by both *Chemical Abstracts* and the American Society for Metals; one exception is *TAB (Technical Abstract Bulletin)*, which is a restricted document, but can still be searched "in-house." NASA's *STAR* contains such a wealth of information in the areas of cryogenics and welding that it is often worth using directly.

* Presented before the Division of Chemical Literature, 156th Meeting, ACS, Atlantic City, N. J., September 13, 1968.

The *Official Gazette of the U.S. Patent Office* is used primarily to check abstracts of patents of which you already have the number. There is no subject index and the Class-Subclass system is difficult to use, as there are so many areas into which any patent can fall, and these classes are being revised constantly. Many patent searches are carried out by company name, but the *Gazette* only lists inventors' names by company, which means every individual patent issued to that company has to be looked at. Long-term searches under a large corporation therefore become too time-consuming, but this problem could be rectified easily if the *Gazette* would only show the titles under company names. *Derwent*, which is the major source of foreign patent abstracts, has no adequate index at the present time, but is promising something better in the future.

The *Uniterm Index of Chemical Patents* deals primarily with chemical patents, and for the aluminum industry is limited to the areas of reduction, coatings, etc. This matching type of index is only an old-fashioned index pulled apart, which requires more work for the searcher, and no additional information is supplied except patent numbers. It is obviously easier for the searcher to use *Chemical Abstracts*. I.F.I. now has an additional service for $5000 per year which will give 50 computer-based searches, and will include titles and inventors. This is probably a worthwhile service for areas where reduction is the principal interest.

Engineering Index, in general, has less coverage of the industry than *A.S.M.* or *CA*, but can be a useful supplement in the area of end uses.

Electrical Engineering Abstracts is an ideal source in the area of conductors, and gives considerable coverage in this area which is not picked up by the two major sources.

In 1968, the American Society for Metals and the Institute of Metals combined their resources (*A.S.M. Review* and *Metallurgical Abstracts*) into one publication called *Metals Abstracts*. In principle, this was an ideal arrangement, but in the final product we have had a loss. The *A.S.M. Review* was indexing alloys by composition and had been improving its patent coverage; both of these areas were dropped from *Metals Abstracts*. There were no two areas more important than these to the industry.

Aluminum Technical Information Service is a new publication sponsored by the major North American aluminum producers via the Aluminum Association, and is published by the American Society for Metals. This is the first good attempt to supply an abstract journal entirely devoted to the aluminum industry since Alcan's *Abstract Bulletin*, which ceased publication in 1959. There has been considerable improvement in this publication since it first appeared in March 1968. At the present time, all alloys are indexed by composition and by the Aluminum Association's numerical designations, if they are U.S. alloys. Patent coverage is now excellent and covers fringe areas, such as end uses where aluminum might be used as a competitive material. Patents can now be located by subject, inventor, and company. In the published literature, there was originally some weakness in foreign coverage, which is now being improved. This source is recommended as the primary source for current literature.

Aluminum Abstracts, which is sponsored by Western European aluminum producers, has better coverage at present of the European literature, but we expect *A.T.I.S.* to close this gap in the near future. *Aluminum Abstracts* supplies only an annual index, which is generally two years late in appearance and is only a superficial index; hence, this source is not recommended for retrospective searching.

I will now deal with our two principal sources for retrospective searching; they are *Chemical Abstracts* and the *A.S.M. Review of Metal Literature*. I will deal principally with their treatment of extraction and reduction. It is not my intention to publish a critique of these two excellent sources of information, but rather some guidelines which might be useful to an inexperienced searcher in these areas.

In the aluminum industry we are first concerned with the extraction of alumina from bauxite and, next, the reduction of alumina to aluminum. As this is basically a chemical engineering field, *Chemical Abstracts* is the best source of information. Since *Chemical Abstracts* does not, unfortunately, furnish a thesaurus to its customers, you will have to choose the logical terms to search under. In each annual subject index, you have lists of instructions on how certain areas are indexed, but these are not updated and collated; it would be of tremendous value if these instructions could be published as a separate publication.

In *Chemical Abstracts*, extraction of alumina from bauxite is not indexed under the Bayer Process or Bauxite or Alumina, but in general under the main heading of "Aluminum, Process metallurgy of," and the next word "bauxite," but if you want extraction from other ores —e.g., clays, Kaolin, etc.—you must go to the heading "Aluminum oxide, Manufacture or recovery of," and thence to the material required. Unfortunately, a lot of the work on the Bayer Process is contained here also, as well as under aluminum oxide itself, and has not been cross-indexed, so you must look in several areas. Red mud filtration, flocculation, silica removal, soda loss, etc., will, in general, be under "Aluminum oxide, manufacture or recovery from," but such subjects as extraction of gallium from Bayer liquors, which are not directly part of the process, may or may not be under the headings mentioned.

The same problem of extraction is now handled by the *A.S.M. Review of Metal Literature* in a simpler and more concise manner; most of the literature would be found under "Aluminum Oxide, Extraction," with further entries under the process—e.g., Bayer Process—and an excellent job of cross-indexing. Material dealing directly with the ores is found under the specific ore—e.g., "Bauxite, Beneficiation." Since 1964, the A.S.M. have been using probably the best thesaurus in the industry, which is now for sale to its customers.

Typical Index Entries Found in the A.S.M. Review and Chemical Abstracts

A.S.M. Review of Metal Literature

1. Aluminum Oxide, Extraction
   Studies of processing Indian Bauxite to produce alumina 66-07 MO3-44293
   Leaching of red slurry obtained in the production of alumina 66-07 MO3-45618

2. Bayer Process
   Studies of processing Indian Bauxite to produce alumina 66-07 MO3-44293
   The effect of organic substances on the Bayer aluminum oxide process 66-06 MO3-43128
3. Bauxite, Beneficiation
   The effect of radiation on the rate of leaching bauxite 66-07 MO2-4561
   A material balance in the leaching of bauxite clinker 66-08 MO2-47331

Chemical Abstracts

4. Aluminum, Process metallurgy of
   from bauxite, **51**: P12712*f*
   by NaOH treatment, **51**: P8399*a*
5. Aluminum oxide, Manufacture or recovery of
   from Al-contg. phosphate rock, **65**: P10182*g*
   from bauxite, **65**: 11831*g*
   red mud from, NaOH recovery from, **65**: 1821*h*

Next, we approach the problem of Reduction. Beginning with *Chemical Abstracts*, "Aluminum, Metallurgy of" (now changed to Aluminum, Process Metallurgy of) again is the basic heading. Certainly most of the literature appears under this main heading as various subdivisions, but we must be careful in our choice of subentries; references to pot-lining can be found under "carbon cathodes," as well as the subdivision "cells for," and we cannot restrict ourselves to the above main entry—e.g., air pollution from fluorides is partly covered under the above main heading, but additional information is located under the main entry "Air, Pollution of," and these have not been cross-indexed.

We might point out here that the idea that "see" and "see also" references in most indices will lead the novice to the proper entry is not necessarily true. "See" and "See also" references from the broad to the narrower terms are generally shown, but the reverse situation is not generally shown; related terms are rarely shown as "see also" references, although they exist as such.

Getting back to "Reduction," using the *A.S.M. Review of Metal Literature*, some material on the basic process will be under "Aluminum, Reduction (Chemical)," with additional material under "Aluminum, Electrolysis;" "Aluminum;" "Electrodes;" "Aluminum, Electrorefining;" "Electrolysis;" "Electrolysis, Fused Salts;" "Electrolytes;" "Anodes;" "Cathodes;" "Soderberg Electrodes;" etc. Unfortunately, indexing has been much less consistent in this area than in the Bayer Process. The same type of material found under "Aluminum, Reduction" is also located under "Aluminum, Electrolysis;" "Aluminum, Electrorefining;" "Electrolytes;" and "Electrolysis." It would be a great advantage if all of this material could appear under "Aluminum, Reduction" with proper subdivisions. In fact, some references appear under "Aluminum Oxide, Electrolysis." In the older editions of *A.S.M. Review of Metal Literature*, the main entry is "Aluminum, Electrowinning," but the coverage on reduction was not very heavy until 1965.

Chemical Abstracts

6. Aluminum, Process metallurgy of
   carbon cathodes in, deformation of **51**: 13614*f*
   cells for
   linings for **65**: P6748*a*
   fluoride determination in air of plants **54**: 12839*i*

A.S.M. Review of Metal Literature

7. Aluminum, Reduction (Chemical)
   Measurement of temperature in aluminum reduction electrolytic cells 65-05 M19-21249
8. Aluminum, Electrolysis
   Calculation of heat insulation of sidewalls of aluminum electrolytic cells 65-07 MO3-23184
9. Electrolysis
   Influence of anodic mass composition on anode stability during electrolysis of cryolite—alumina melts 65-01 MO3-13145

The next area that we will explore is the handling of aluminum alloys. Until recently, *Chemical Abstracts* indexed alloys alphabetically by element rather than by composition. Although symbols are used, the symbol appears in the order of the element named—e.g., Sn appears in the place of T. In addition, the term "Aluminum Alloys" refers to aluminum-containing alloys, not necessarily aluminum-base alloys. This means that if you are searching for either a particular alloy—e.g., 6063 or 7075, or particular families, e.g., Al-Zn (7000 series) or Al-Mg-Si (6000 series)—you must search through the complete aluminum alloy section, picking out any alloy showing either Zn or a combination of Mg and Si. To be more thorough, you would have to search alphabetically for the elements Al, Si, Fe, Cu, Mn, Mg, Cr, Zn, and Ti, which includes the possible elements taken two at a time, three at a time, etc., depending on how many elements the indexer has shown. A lot of the alloys which drop out will not even be aluminum alloys. In other sources, such as the *A.S.M. Review of Metal Literature*, you can go directly to Al-Zn or Al-Mg-Si with or without additional elements.

I have been able to obtain full cooperation from *Chemical Abstracts* in this respect. Beginning with Volume **66**, 1967, they index first by the base element and then in descending order of content where content is known; when content is not known, it will be done in alphabetical order and starred. There will also be main entry cross-indexing under each individual element, and so indicated as containing over 1% of that particular element.

You cannot search directly by alloy number in either *Chemical Abstracts* or the *A.S.M. Review of Metal Literature*. The first index set up this way in the aluminum industry was Alcan's *Abstract Bulletin. Aluminum Technical Information Service* uses Aluminum Association designations as of August, 1968. It would be to our advantage if these publications consider this idea; the objection that numerical designations vary between countries is not serious, since equivalents can be located easily, at least for the western world.

Getting back to patents, *Chemical Abstracts* is the best source of metallurgical patents on a long-term basis. The *A.S.M. Review of Metal Literature* has only begun to cover patents recently. Other sources, in general, do not cover them at all, or only in very specific fields.

In *Chemical Abstracts* we can quickly pick up patents under company, inventor, number, or subject. Beginning in 1963, they have a Patent Concordance Index which is of great value. Many fields are well covered, including extraction, reduction, corrosion, casting, heat transfer, physical metallurgy, alloy properties based on composition, surface chemistry, electrochemistry, petroleum products, metallography, commercial aluminas, and toxicology; this coverage, of course, applies to all published literature. Coverage in the following fields is naturally of less concern to *Chemical Abstracts*, and they are not as well covered: mechanical working, machining, joining and welding, plant equipment, instrumentation, and product design. It is in these areas, particularly in product design, that we have a real problem in patent searching.

In reference to computer-based searching, we should make a comparison here with manual searching. A full-time technically qualified searcher should make 60 to 70 searches per year. These searches will have an average of 15 to 20 years' coverage and will include four or five major sources. This material will be evaluated and a lot of irrelevant material thrown out. There are no computer facilities available, to the best of my knowledge, which can give this combination of broad coverage, time period, and evaluation. If there were such a facility, the costs would probably be in the area of $100 to $200 per year of the literature searched, based on prices now being used by various agencies; in other words, $2000 to $4000 per search. This enormous cost can be reduced by combining several searches into one broad search, but our experience with this approach has been poor. In general, the program would not exclude a large drop-out of irrelevant material, and a lot of pertinent material would be lost. In other words, commercial computer searching is not yet economically sound, except in certain restricted areas—e.g., current awareness programs.

In conclusion, an attempt has been made to present the problems of the literature searcher in the aluminum industry, and possibly assist those who have to deal with them, particularly the scientist or engineer who occasionally does some searching.

CODATA—Its Organization, Activities, and Goals*

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In 1966, the International Council of Scientific Unions (ICSU) organized the Committee on Data for Science and Technology (CODATA) to achieve informal coordination among and provide guidance for numerical data compiling projects on a worldwide basis and encourage support for data compiling projects by appropriate private, governmental, and intergovernmental agencies. The committee now has members from eight countries and ten international unions. Each country and some of the unions have established internal mechanisms for carrying out the CODATA aims. Concerned groups in the various countries are linked by informal communication channels. The central office of CODATA, initially in Washington, D. C., but now in Frankfurt, Germany, will soon issue a compendium analyzing the output of principal data evaluation and compilation centers. Task groups have been established to cope with special problems—i.e., fundamental constants, application of computers to numerical data processing, standardizing "key" input data used by compilers, etc. A trend is evident toward cooperation among numerical data compilers on a worldwide basis.

In September 1966, at the New York ACS Symposium, I reported on the then recently formed Committee on Data for Science and Technology (CODATA) of the International Council of Scientific Unions (ICSU).

Before I bring the story of CODATA up to date, I shall quickly review the background of the problem, the mission, and the framework of the organization.

BACKGROUND

I trace the background, as viewed from the U. S. A. The National Academy of Sciences began its formal interest in the problem of evaluated data for science and technology in 1919. In that year, the International Union of Pure and Applied Chemistry, meeting in London, established the International Critical Tables, with the National Academy of Sciences of the U. S. A. being assigned the financial and editorial responsibility for the work. In 1923, the International Research Council, which later became the International Council of Scientific Unions, gave its patronage to the project. With Edward W. Washburn as Editor-in-Chief, and with the cooperation of 408 scientists in 18 countries, the complete work of seven volumes was issued in the years 1926 to 1930, with a separate index volume following in 1933.[1]

Between 1933 and 1957, a limited number of excellent numerical data compilation centers were organized spontaneously in the U. S., but with no coordination among them and no coverage of many areas of science. The Landolt-Börnstein Tabellen[2] in Germany and the Tables

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