

DOCUMENTATION

BY

S. C. BRADFORD, D.Sc., F.L.A.

President of the British Society for International Bibliography,
Vice-President of the International Federation for Documentation,
Chairman of the International Commission of the Universal Decimal
Classification, Keeper of the Science Library, retired.

London

CROSBY LOCKWOOD & SON LTD.

39 THURLOE STREET, S.W.7

1948

First published 1948.

PRINTED IN GREAT BRITAIN BY
THE GARDEN CITY PRESS LIMITED
AT LETCHWORTH HERTFORDSHIRE

FOREWORD

MORE than half a century ago La Fontaine and Otlet started their lives' work, which at first was connected with the term "Bibliography," but to which gradually the word "Documentation" was attributed. What they developed was of a far wider scope than the establishment of a new technique dealing with printed and non-printed documents.

The great ideal which inspired them, and those who worked side by side with them, was to render accessible the totality of what is crystallized from human thought and to make of it a common treasure of mankind, serving to bring mutual comprehension and to build for peace by the co-operation of all men of goodwill of all nations.

It was in this spirit that my friend Bradford joined those men, whose noble faces have passed and to whom it never was given to see the achievement of the work to which they devoted their lives.

And it was in this spirit that Bradford, thanks to his knowledge and experience as scientist as well as librarian, not only gave his strong and valuable support to the common work but added to it fundamental and constructive new elements.

Just for this reason the present book we owe to him gives far more than a mere compilation of facts and experiences. Such a compilation would indeed be welcome because, curiously enough, up to now, there is no good general treatise on documentation available. But his book gives us before all things an abundance of original ideas and creative thoughts.

May it find many readers who will understand its fundamental value and who will be able to build further on it to the benefit of international understanding.

*The Hague,
May 5th, 1948.*

F. DONKER-DUYVIS.

PREFACE

THE subject of this treatise has now attained a decent age. It is no longer new. The art of documentation has come to be regarded as a practical necessity, as the only means of avoiding waste of effort in the progress of intellectual activity. During fifty years, the fundamental principles of the art have gradually been evolved. Perhaps this is the reason why so few comprehensive treatises have, as yet, appeared. In 1934 Paul Otlet produced his "Traité de Documentation: le livre sur le livre," which was published in Brussels. No other comprehensive work has since been published, until the first part of Dr. O. Frank's "Die Decimal Klassifikation" came out in Berlin in 1946.

As an English text-book on the whole subject is still lacking, I have been urged to write one. Hence the present volume. The work is based, in the main, on studies I have communicated to the British Society for International Bibliography and published in its *Proceedings*, or as *Publication* No. 2. I have included, also, excerpts from a contribution to the *Communications* of the International Federation for Documentation and from a paper read before the Royal Society Empire Scientific Conference in June, 1946. My best thanks are due to these bodies for their kind permission to reproduce much of these studies.

Altogether the work forms a concise and fairly comprehensive text-book on the subject. I hope that it will prove of some little use to my fellow workers in their daily tasks.

*Mulberry Cottage,
Wimbledon.*

S. C. BRADFORD.
July, 1947.

CONTENTS

	<i>Page</i>
FOREWORD	5
PREFACE	6
INTRODUCTION	9
CHAPTER	
I. The nature, origin and purpose of documentation	11
II. Alphabetical subject indexing	18
III. The Universal Decimal Classification	24
IV. The preparation of subject indexes to volumes of periodicals	49
V. General abstracting services	58
VI. The organisation of a library service in science and technology	64
VII. Special libraries and special information services	85
VIII. Fifty years of documentation	94
IX. The documentary chaos	106
X. A plan for complete scientific documentation	122
XI. Some general principles of a bibliographical classification scheme, with some suggestions for eventually improving the Universal Decimal Classification	131
XII. For and against the decimal classification	142

INTRODUCTION

It has become important that every man should realise the part played by science and technology in industrial progress. The period of stress, in which we are involved, should pass. The time should come again when we shall live in plenty. That plenty will have been produced by the efficient application of scientific knowledge. Documentation is a key to this application and to our emergence from our present troubles. Every man should understand the manner of its working. This small book is intended to explain the subject in the simplest terms.

In every stage, beginning with the establishment of a scientific law, through its application to the production of some object of our daily life, and the subsequent improvement of that object, documentation plays a vital part. Only by its proper use can industry be made thoroughly efficient, so that our goods may hold their place in the markets of the world and provide the money needed to obtain the means to live.

Science consists of knowledge arranged under general truths and principles. First, measurements are made, usually by different investigators, of some occurrence not sufficiently apprehended. These observations are recorded in some scientific journals, of which there are an exceedingly great number. The separate measurements are brought together by some individual, who has the insight to see that they will fit into some simple law or new invention. Newton's famous law of gravitation might, indeed, have been discovered by the observation of the fall of apples. Not of one apple only, but of many apples, falling from different heights, and by measuring the different times of fall, together with the various velocities attained. So, by measurement, are all new discoveries achieved.

Documentation is the process of collecting and subject to classifying all the records of new observations and making

them available, at need, to the discoverer or the inventor. Without documentation, the recorded observations are merely scattered items, separately of little use, which get buried in the great mass of scientific literature, like needles in a haystack.

In the past, the great usefulness of documentation has not been adequately realised. Only gradually, by very slow degrees, has its importance become manifest. First, we began to realise the need for guidance in what subjects were treated in particular books, and in what books there were on particular topics. The recognition of this need has led to the production of readers' guides and lists of books classified by subject. These, again, have induced the study of the subsidiary subject of the science of classification. But such lists of books have always been inadequate in two respects. Firstly, no list of books contains particulars of more than a fraction of those that have been written. And secondly, the books themselves are often out of date, in regard to the facts they record, before they have been printed. Generally speaking, a new fact is not incorporated in a book for several years, and then, not in sufficient detail for a scientific worker.

Scientific progress needs that new facts, new discoveries and the new inventions resulting from them, should be made available immediately. For this purpose, ordinary books and lists of books are useless. Books are for the study of a subject, not for its evolution.

As we have seen above, new observations are recorded in scientific and in technical periodicals. We need the means of assembling all these new facts and of sorting them, according to their minutely particular aspects, so that we can find out, at once, all those relating to the special subject that we wish to study. This is the province of the art of documentation and the reason why the subject is of vital interest to all.

CHAPTER I

THE NATURE, ORIGIN AND PURPOSE OF DOCUMENTATION

Documenter c'est réunir, classer et distribuer des documents de tout genre dans tous les domaines de l'activité humaine.

The nature of documentation. Documentation is an art of practical necessity, practised by a brotherhood of enthusiastic devotees, whose painstaking altruistic labours contribute, in modest obscurity, towards the progress of society. For progress depends on access to recorded information. And the art of documentation is the art of collecting, classifying and making readily accessible the records of all kinds of intellectual activity. It is the process by which the documentalist is enabled to put before the creative specialist the existing literature, bearing on the subject of his investigation, in order that he may be made fully aware of previous achievements in his subject, and thus be saved from the dissipation of his genius upon work already done. Documentation proceeds from the need to put in order the processes of acquiring, preserving, abstracting and supplying, as required, books, articles and reports, data and documents of all kinds. It is the result of the realisation of the gap between the making of a record in any sphere of activity and the placing of that record in the hands of the individual who can use it as the basis of new achievement. The principal medium for recording progress is the periodical press, which speaks in so irregular and incoherent a manner, that it is impossible, without documentation, to obtain a clear and concise view of any particular branch of knowledge, large or small. This disorder reigns in the production of documents of all kinds. Documentation is the necessary remedy.

It will be observed, at once, that documentation is no more than one aspect of the larger art of librarianship. But it is a special aspect, needing special study. For, while the wide subject of librarianship is concerned with every aspect of the treatment of books, the business of the documentalist is to make available the original information that has been recorded in articles in periodicals, pamphlets, reports, patent specifications and such-like records. Because the material, with which it deals, is so much the more voluminous, its methods must be so much the more precise. So, by his unostentatious drudgery, the documentalist contributes to the increased production of the genius, and becomes, by proxy, the benefactor of mankind.

The work of the documentalist supplies the master-key referred to by Viscount Swinton in his preface to the *Report of Proceedings of the First Conference on Information Bureaux and Special Libraries*: "The growth of knowledge during living memory has been remarkable and its application evident in every direction. Whilst it is generally recognized that 'knowledge is power' it is none the less true that a considerable proportion of accumulated knowledge, whether in the domain of science, business, sociology, education, or elsewhere, is unfortunately lying dormant and untapped.

"That this state of affairs prevails is much to be regretted. An immense amount of extremely valuable information is in existence, if only one knows where to find it. The volume of modern knowledge being far beyond the mental grasp of any individual or group of persons however erudite, it becomes a vital necessity to provide a master-key whereby this common storehouse may be unlocked."

The origin of documentation. Especially in the domain of science and technology, the unprecedented progress during the last hundred years has produced a truly overwhelming flood of literature, describing new inventions and discoveries. A hundred years ago, a scientific man could digest for himself the whole existing literature of his special subject. To-day, it is only by employing a new kind of periodical, which abstracts current scientific literature, that he can, with difficulty, keep himself informed of some only of the articles and books appearing that have information on the special subject of his study.

These "abstracting" periodicals were the first practical

attempt to bring recorded information to the notice of the original investigator. They constitute the first, and not the least important, practical beginnings of the art of making accessible the inchoate mass of recorded information.

Naturally, the *fons et origo* of the art coincide with the epoch of the first production of the printed book,

“When, in his dark room, the lone mechanic stood
And shaped in letters the obedient wood.”

Classification is the fundamental basis of the process of documentation. And its origin may be traced, not so much to intellectual needs as to ordinary business necessity. The earliest known catalogues, which described the stock-in-trade of the fathers of printing, were crudely classified. Thus, in 1498, the elder Aldus published a catalogue of “*Libri Græci impressi*,” which was divided into the classes :

- | | |
|---------------|---------------------|
| 1. Grammatica | 4. Philosophica |
| 2. Poetica | 5. Sacra Scriptura. |
| 3. Logica | |

In the catalogue of Robert Etienne, published in 1546, the following classes are included :

- | | |
|---------------|-----------------|
| 1. Hebræa | 8. Rhetorica |
| 2. Græca | 9. Oratoria |
| 3. Sacra | 10. Dialectica |
| 4. Profana | 11. Philosophia |
| 5. Grammatica | 12. Arithmetica |
| 6. Poetica | 13. Geometrica |
| 7. Historia | 14. Medica. |

The development of ordinary library catalogues was very slow. What has been described as the first classification designed for the use, rather than the sale of books, was published by Conrad Gesner, in 1548, in the shape of an index of subjects to his *Bibliotheca Universalis*, under the title “*Pandectarum sive partitionum universalium, libri xxi.*”

Up to 1840, no considerable library had adequate means whereby to ascertain its resources of information on a particular subject. And no large library was, as yet, completely catalogued. Until this time, all libraries were still mere

museums of books, where, in the words of John Halle, written three centuries before :

“ As some delighte most to beholde
Each new devyse and guyse,
So some in works of fathers olde
Their studies exercise.”

By 1840, however, the two main types of library catalogue, author and subject, had been recognized, and the general principles, upon which the former should be prepared, had been worked out in detail by that great librarian Panizzi. These were exemplified in the single volume of the “ Catalogue of Printed Books in the Library of the British Museum,” which was published in 1841.

About this time, the advantages of the classified subject catalogue were beginning to be appreciated by some librarians. Thus, in 1859, Edward Edwards wrote in his well-known “ Handbook of Library Economy,” volume II, p. 755, “ Catalogues on this [alphabetical] plan certainly add . . . the . . . merit—at least as respects certain students—of requiring no previous acquaintance with systems of classification. But these merits have to be weighed against grave defects. Of necessity, such catalogues must deal rather with the phraseology of title-pages than with the real subject matter of books, and, therefore, fail to bring under one view all, or any near approximation to all, the books they contain on any given topic. In some cases, one word will have several distinct significations, and then the reader’s search is embarrassed with matter foreign to his purpose ; in others, one theme is expressible by several synonyms, or convertible terms, and then all these must be turned to, before he can be certain that he has the information of which he is in quest.

“ As an instance of the first kind of difficulty, . . . let the reader turn to . . . [the word ESTATE] in the ‘ Bibliotheca Britannica,’ and he will find, amongst many others, the titles which follow :

The Estates, empires and principalities of the world.

. . .

A discourse of the well-ordering an honorable Estate.

. . .

A discourse concerning Estate, tayle and descents of inheritance.

. . .

A discourse upon grants and resumptions, showing that the forfeited Estates ought to be applied to the payment of public debts.

...

"Obviously, this word is used in these four titles in four different senses ; a matter of no moment, if these four titles were all that appeared ; but we have only to imagine . . . a hundred other titles intermingled amongst them, and the reality of the difficulty spoken of will become sufficiently apparent."

After quoting examples of the second difficulty, Edwards concludes " this alphabetical method is far less adapted to the main body of a catalogue than to its auxiliary index."

It was not until 1873, that the idea of the employment of a standard classification, provided with a decimal notation, and an alphabetical index to the symbols, for the arrangement of the books and other documents in all libraries was invented by Melvil Dewey. Years of study had convinced him that the usefulness of libraries could be much increased, without additional expense, by the adoption of a properly developed subject classification, by means of which the users of a library could readily ascertain what documents had been collected on the subject that they wished to study. The Dewey " Decimal Classification and Relativ Index " was first put into operation in Amhurst College Library, Amhurst, Mass., U.S.A., in 1873. The classification was submitted as the thesis for his master's degree in 1875, and first published in 1876. This important event, for which the world owes Melvil Dewey a debt of gratitude, marks the beginning of a new era in library organization, when librarians first began to perform their dual task of collecting the printed records of human work and thought and of making accessible the information recorded on a particular subject.

The first edition of Dewey's Classification comprised twenty-four pages only, of which half were devoted to the Relativ Index. The value of the Classification was rapidly realized. Its use extended into every corner of the United States. New editions were frequently required, each more extended than the previous. Until, now, the current fourteenth edition, dated 1942, comprises 1,929 pages and one plate : a portrait of its celebrated author. Dewey's Classification was first

introduced into this country in 1893, when it was put into operation in the Ashton-under-Lyne Public Library. Now it has become the most widely used library classification. To-day most large libraries are completely catalogued by authors, and many are provided with, at least, a partial subject catalogue.

The purpose of documentation. While library technique was still in process of development, scientific men had already found it necessary to consider how to deal with the growing mass of individual papers published in the Transactions of Societies and independent Journals : papers recording original investigations, and, therefore, constituting the foundation, on which further progress must be based. These papers needed cataloguing just as much, or even more, than books, which only record a summary of original discovery, after the pioneers are many years ahead.

Perhaps the first suggestion to prepare a comprehensive catalogue of the whole of scientific periodical literature was made to the British Association in 1855, by Prof. Henry of Washington. Eventually the suggestion first bore fruit in the production of the "Catalogue of Scientific Papers" published by the Royal Society from 1867 onwards. Simultaneously the "Index to foreign scientific periodicals contained in the Patent Office Library" began to appear. The Royal Society's Catalogue is still in progress. Unfortunately the Patent Office Index ceased to appear with the volume for 1872. It is interesting to observe that the same ideas were involved in the preparation of these catalogues of papers as were seen in the earliest catalogues of books. For, while the Royal Society's Catalogue was arranged alphabetically under authors, the Patent Office Library's Index was classified.

Even before the Royal Society's Catalogue, however, the output of scientific periodical literature had increased so much that it had become impossible for a scientific man to digest even all the literature of his own branch of knowledge, and so keep up to date within it. A new type of periodical was needed, which should survey broad fields of knowledge and summarize all important current papers in those fields, thus providing a bird'-eye view of progress. The earliest to appear of this new type of periodical was the *Pharmaceutisches Central-*

blatt (afterwards *Chemisches Zentralblatt*), which commenced in 1830 and continues to this day.

This first "abstracting periodical" was succeeded in the course of time by many others, covering definite fields of science and giving either abstracts of the current papers, short annotations, or even merely references to them. Of such were the *Quarterly Journal of the Chemical Society* (now *British Abstracts*), which began in 1847, the *Zoological Record*, 1864, and onwards, and the *Engineering Index*, commencing in 1884. All these are still in progress.

So were developed, side by side, a set of abstracting periodicals, providing summaries of individual current papers and the Royal Society's comprehensive catalogue, by authors, giving only titles of them all.

The abstracting periodicals were provided with annual alphabetical indexes of subjects. And these were cumulated into quinquennial, or decennial, volumes. Thus, in theory, it was possible to trace what had been achieved on a particular subject in past years. Practice, however, did not quite conform to theory. The alphabetical method of arrangement was adopted for these indexes. And this does not lend itself to subject indexing, because a single subject can be described in such a great variety of combinations of words, and because related subjects are scattered throughout the alphabetical labyrinth. The self-same subjects were indexed under different headings in the same index and in different places in different indexes. While similar subjects were to be found in almost any place in the index. The difficulties were, of course, accentuated because the indexes were published in different languages in different countries. To ascertain what had been written on a subject, it was necessary actually to read through the indexes from beginning to end. And, as there are, perhaps, a dozen or a score of abstracting, or indexing, periodicals to each subject, this labour had to be performed for them all. It was only one degree less troublesome than reading all the papers.

Thus the need for the adoption of a standard classification for the use of abstracting periodicals, as for books, became apparent. / This will be discussed in more detail in the next chapter.

CHAPTER II

ALPHABETICAL SUBJECT INDEXING

THE making of indexes is almost as old as the printing of books. We have seen how the first catalogues were made by publishers for their own use and that of their customers. Very soon it was realized that

“Productive was the world in many things, but most in books. Like swarms of locusts, which God sent to vex a land.”—POLLOCK.

When, in addition, scientific papers poured their annual deluges on man, subject indexes of articles became essential. It was, of course, quite natural that the first indexes should be made on an alphabetical system. Some word in the title, or some term, considered more adequately to express the subject of the book or paper, being chosen as a catch-word, under which to arrange the title. Such indexes are still made to-day. The main objection, and there are many, is that words are more suitable to hide our meaning than express it.

“Words are like leaves, and where they most abound
Much fruit of sense beneath is rarely found.”—POPE.

The number of synonyms. It happens rarely that a single word is suitable to express the subject of an article. Usually a compound expression is required. But even when a single word suffices, the same idea may be signified by a number of synonymous expressions, *e.g.* a balloon may be also an aerostat, a dirigible, or a lighter than air craft, with corresponding terms in all the different languages. When several words are needed, any one of which may serve as the catch-word heading, the number of possible entries becomes legion, especially in a large index, where every entry has several sub-entries and many items under each.

Take for example, quite at random, from perhaps the best existing alphabetical index, the entry :

Oil Well Drilling—Rotary. Preparation of hard alloys for oil-well drilling. N. Pravdyuk and V. Negreyew.

The paper deals with the metallurgy and properties of iron-chromium and tungsten alloys for making bits for boring machines. If a description of the subject were to be written in the order of importance of the terms from the authors' point of view, we should get, perhaps: Iron chromium and tungsten alloys for bits for boring machines for drilling wells for oil. Thus the indexer, evidently working from the title and not from the contents of the paper, has effectively hidden a reference to the metallurgy of hard alloys under an arbitrary sub-division of a heading commencing with the least important word in the title, and this, although other papers on the subject, but not this one, occur under such headings as "Chromium-iron alloys," "Tungsten alloys," "Alloys," "Boring machines" and "Drilling machines." It would be difficult to find this paper from the index, without reading through the index, item by item, and this is usually how one has to dig out the information hidden in the best alphabetical indexes.

This particular paper contains nine important words expressing the authors' conception of their subject. These nine words have many synonyms and different terms in different languages. But, if we consider only the nine words, as the authors give them, without any alternatives, any one of them may be chosen by an indexer, from his own particular point of view, as being most important. No one could be less relevant than "oil." Whichever word is chosen, it may be combined with any number of the other words, in any order, making up an entry, such as that above. The number of possible ways, in which this could be done, is nearly a million. The possible entries, at 50 to a page, would fill nearly twenty volumes of a thousand pages each. *Quod est absurdum.*

The incompleteness of bibliographies. To continue the argument, in the analysis of electrical engineering bibliographies, see Chapter IX, it is found that no periodical bibliography

contains as many as half the total number of articles indexed by all the twenty-one bibliographies and that all these must be searched, if we wish to find out all the articles that have been indexed on this subject. Comparison of other bibliographies shows that this sort of thing is true of all subjects. No bibliography is complete and all must be searched. The alphabetical method is calculated to make this search as laborious as possible.

The scattering of references to related topics and the juxtaposition of references to dissimilar topics. Further disadvantages of this method are that it separates references to related subjects, and even to the same subject, and that it brings together entirely unconnected topics. In fact the idea of the alphabetical arrangement of subjects is quite incompatible with the conception of their classification. In practice, it is impossible to apply purely alphabetical arrangement in any really comprehensive bibliography. As we have seen, the number of possible arrangements of words, that might be chosen to express each of the ideas to be indexed, is so enormous, that it becomes imperative to use only a carefully chosen selection of subject headings. Moreover, information on each possible subject of enquiry is to be found both in larger conceptions which include that subject, and in smaller groups, into which the conception might be subdivided. But, as the alphabetical arrangement scatters all such related groups of ideas, large and small, throughout the index, both larger and smaller groups have to be connected by cross-references.

The concealed classification. Consequently, all considerable alphabetical subject indexes are constructed on a carefully selected series of subject headings, combined with an elaborate system of cross-references, which amount, together, to a concealed classification. This concealed classification is before the bibliographer in making each new entry. It is withheld from the enquirer, who is compelled patiently to piece it together, as he laboriously digs out the hidden information.

Further, this elaborate concealed network of cross-references cannot be complete. It is usual to supplement the scheme with words taken from the titles of the papers indexed. Because

of the mass of synonyms available to authors, articles essentially similar in content are differently described. The words, chosen from the title by the indexer, do not fit his system of cross-references, and even if he adds some fresh ones, the entries tend to become hopelessly lost in the alphabetical labyrinth.

Failure of the method in practice. We may see how such a system works in practice, by just glancing through the headings in a good alphabetical index. The faults in this index are those inseparable from the system, which no reasonable care on the part of the editor could have avoided, *i.e.* the juxtaposition of incongruous entries and the separation of related ones. Let us try to find what papers have been indexed on the properties of living cells. Under the heading CELLS, with a reference to one article on living cells, we find a reference to a paper on the geometrical properties of space: Stakability of Tetraikadekahedra. This recalls the librarian's classical error of entering "Lead Kindly Light" with "Lead Pipes."

To pursue this search for papers on the properties of living cells, besides these two papers indexed under CELLS, we find cross-references to EMBRYOLOGY, GOLGI APPARATUS, KARIOKINESIS, PLANT CELLS and TUMOURS. And under each of these headings there are several further cross-references, and so on, and so on. Each cross-reference leading to a new heading, or back again to one already looked at.

Let us examine another example in more detail, *i.e.* the acoustics of buildings. Under ACOUSTICS, there are no entries, but there is a cross-reference to SOUND. Here again we are disappointed. There is only a cross-reference back again to ACOUSTICS. We now follow a further cross-reference from ACOUSTICS to ARCHITECTURAL ACOUSTICS. And here we find eight papers listed. From this heading there is another cross-reference to MUSIC: ACOUSTICS, which we must look at, only to find a cross-reference back to SOUND, which we have already looked at. So far we have found only eight papers. From MUSIC: ACOUSTICS there is another cross-reference back to ARCHITECTURAL ACOUSTICS, of which we have seen enough. But there is another cross-reference to ECHO and here we find

references to two new papers. But no reference to the Albert Hall echo appears here. For this we have to look under ALBERT HALL, having found a cross-reference to this heading from ARCHITECTURAL ACOUSTICS. This heading gives two other cross-references, e.g. to BUILDINGS : SOUND PROOFING and CHURCH ARCHITECTURE. Under the former we find three other papers and under the latter two more. Altogether, we have found references to sixteen papers, and are left wondering whether there are any more.

Suppose, again, we wish to look for articles on geophysical prospecting. Under GEOPHYSICS we find no references, only a cross-reference to PROSPECTING, where we find our first reference to an article, and another cross-reference to ELECTRICAL PROSPECTING, where we find a reference to another paper. From here we are directed to TORSION BALANCE, which provides a reference to a further paper. No reference seems to be given anywhere to a paper entitled "Applications of Sound-prospecting to Geophysics," which we discover accidentally, indexed under SOUND-PROPAGATION, and could hardly have found otherwise. Up to now we have only located four papers and are left with the uneasy feeling that there must be more; if only we knew where to look for them. These are the papers of only a single year and the wearisome business has to be repeated for each year and each bibliography.

When we realise that no bibliography is at all complete, that there are usually at least a dozen periodical bibliographies to be looked through for each subject and that each bibliography has to be explored in this provoking manner, if we would hope to gather all the information that has been indexed on a subject, we realize the complete futility of the alphabetical subject index.

Unsuitability of the method for co-operation. The final objection to the alphabetical arrangement of subject indexes, if one more were needed, is that every index so arranged must be kept apart, because each arrangement is entirely different. Thus, the alphabetical system is entirely unsuitable for international co-operation.

There are those who endeavour to support the method

by the statement that an alphabetical index is needed anyway for a classified subject index, and ask why should it be necessary to complicate the method by introducing a subject classification. The answer to these critics is, both that a concealed subject classification is an essential part of any extensive alphabetical index and that the alphabetical index to a classification, when it is used openly, is not absolutely necessary. This index is rarely referred to by an expert classifier, who works directly from the schedules of the classification. It is possible even for the novice to do the same, as is explained in the next chapter. Moreover, the alphabetical index to the subject classification is much simpler than the alphabetical arrangement of a subject index, because it contains few cross-references. It serves merely to direct the user to the proper place in the schedules. The schedules themselves bring related subjects together in their proper relation to the larger subjects, of which they form a part, and to the smaller subjects, into which they are themselves divided. Both these groups, the larger and the smaller, contain references to articles, which may be of use from the particular aspect of an inquiry and are automatically brought to the notice of the inquirer.

CHAPTER III

THE UNIVERSAL DECIMAL CLASSIFICATION

FROM the complexities of alphabetical arrangement, we turn to the simple scientific classification of subjects. All the disadvantages of the former method immediately disappear. According to our point of view, there are definite places in a properly classified subject index, where the references to the recorded information, relative to our subject of enquiry, are collected. We have only to go to these places to discover the references. It is, of course, important that all the references we wish to consult should have been classified by the same system. Otherwise, we cannot intercalate them into one index. We are obliged to keep them separate and study each system of classification separately. Very many different systems have been invented, each one claimed to be the best. There is at least one gentleman who collects systems of classification, as others collect postage stamps. Fortunately there is only one system of classification, which is sufficiently subdivided and extensive, to be used for classifying scientific papers and which has been used to any considerable extent by different bibliographers. This system is the Universal Decimal Classification. We shall now consider this system in detail.

The origin and purpose of the Classification. With the perpetual increase in bulk, range and complexity of information in every branch of knowledge, increases also the need for direction where to find it. This need is most imperative in the fields of science and industry, where economic conditions have compelled the organization of scientific and technological research and are now enforcing the rationalization of bibliographical research, which must precede experimental investigation. For

unless a piece of work can be brought to the notice of the inquirer who can use it, it has already passed into oblivion. The extravagant repetition of scientific work, which the lack of adequate bibliographies entails, can be avoided only by the compilation of an index to all the published information that is likely to be of use to the research worker.

As such a comprehensive index needs the co-operation of many bibliographers in many countries, it must be based on a uniform system of classification of universal application, whatever be the source of the information, the language in which it is recorded, or the subject to which it appertains.

The Universal Decimal Classification was designed for indexing, by subject, all branches of the literature of the world. But, so far as the author knows, there has been no urge for comprehensive subject indexes from experts in the fields of knowledge other than those of Science and Technology. Indeed, although the author has been careful to avoid interference in subjects on which he is not qualified to speak, he has been politely, but firmly, warned that he should adopt the philosophy of *Candide* and cultivate his garden. These experts have not agreed upon a classification. No statistical investigations seem to have been made of the amount of such literature to be indexed, of the extent to which it is covered by existing abstracting agencies, or of the cost of indexing it by subject. It is not established how far complete indexes of individual papers, or compositions, in such subjects as Religion, Literature, Music, Art, etc., may be desirable, or what useful purpose they would serve.

When the need for such indexes is made manifest, statistical investigations in these subjects could be made, as they have been made in Science. This could be done by experts, working in libraries receiving representative collections of literature, and under the guidance of persons with adequate knowledge of statistical methods. Then, when the indispensable data have been made available, it would be possible to decide the most economic means of producing such indexes as the experts need.

What we do know is, that we are repeating scientific work that has been done before, that a complete subject index to scientific literature would save this wasted effort ; and that the

Universal Decimal Classification is suitable for making such an index.

In considering this Classification we must rid our minds of any idea of the arrangement of books on shelves, for it is impracticable to bring together on the shelf all the monographs, bulletins, reports, papers, patent specifications, cuttings and diagrams that relate to any particular subject. The object of the classification is to index the reference to every document in such a way that the document may be found with the minimum of labour for use in further progress. Such a classification must be comprehensive both as regards the past and present, it must have subdivisions so minute that the smallest branch of any subject may be represented, and be capable of further subdivision in the future. The order of the classification should be readily intelligible to the ordinary user, but it is unnecessary and impossible that it should be absolutely logical. Even could a perfectly logical classification be established at any time, it must become illogical with the progress of knowledge. Yet a standard system must not be changed frequently. Differences in language render any alphabetical arrangement of subjects unsuitable for international use. The use of symbols of an ordered notation, generally recognized, remains as a possible system, each subdivision of the classification being represented by a symbol.

Description of the Classification. The decimal notation, for specifying the classes of the classification, was adopted, because pure decimal numbers can be subdivided without altering their sequence, are the quickest to arrange and find and are known throughout America, Europe, the British Empire, and elsewhere.

We know that Melvil Dewey published the first edition of his "Decimal classification and relativ index" in 1876. The author is indebted to Mr. H. F. Alexander for the information that, in 1883, a decimal classification was introduced in the Bodleian Library, for arranging its books, by Mr. E. W. B. Nicholson, the Librarian, and that this system is still in use. This would appear to be the first instance of the use of a decimal classification in England. Mr. D. C. Henrik Jones has kindly supplied the information that the Ashton-under-

Lyne Public Library was probably the first library in this country to adopt Dewey's classification, which it did ten years later, in 1893. The Dewey classification is now that most widely used by libraries in England.

When the International Institute of Bibliography was founded in 1895, the Institute adopted the Dewey classification, for extension into an international classification for indexing literature in detail. The first edition of the Universal Decimal Classification was published in 1899 as the "Manuel du répertoire bibliographique universel," twenty-three years after the first edition of the Dewey code. The second edition of the Manuel appeared in 1905, a revise in 1907, and the third and much extended edition in [1927] to 1933 under the title "Classification décimale universelle." These were in French. The fourth edition in German is in course of publication, while the fifth edition in English is now being produced by the British Standards Institution as an English standard.

It may be of some interest to record, that the first published periodical bibliography to be classified by the Decimal Classification, was the *Bibliographia physiologica* from 1893 and onwards. This was followed by the *Bibliographia zoologica* from 1896 and the *Bibliographia anatomica*, which commenced in 1897. All these bibliographies were issued, in card form, by the Concilium Bibliographicum at Zurich and were acknowledged to be the most complete indexes in these subjects. The author remembers well that the *Bibliographia zoologica* was the means of answering the first agricultural inquiry we received in the Science Library: a request from Kenya for information on any means of controlling the coffee bean borer, which was devastating the coffee crops in that Colony. The photographs of articles we supplied resulted in more coffee being grown in the Colony than could be disposed of.

The first publication in this country to adopt the Decimal Classification was *Natural Science*, which began, in 1896, through the initiative of Dr. Bather, the addition of decimal numbers to its articles "to prepare the way for that bibliographical reform, which all admit to be an urgent need."

The Decimal Classification is a good classification, because it is founded on sound bibliographical principles and has been developed gradually in use, by experts in their special subjects.

Its employment brings to the user the advantages of previous experience. It saves mistakes that would otherwise occur and reduces to a minimum the labour of classification and of making annual and cumulated subject indexes. But, *the main purpose of the Classification is to enable the co-operation of many individuals* in the task of indexing, by subject, the literature of the world.

Now, there is a close analogy between the symbols of the Decimal Classification and the words of speech, as both express ideas. We know that words may tend in time to lose their first intensity of meaning. To-day we say "a god-forsaken place," without in any way intending to imply that it is a place of lurid negation or ruinous quiet. Or, we talk of "shrapnel" when we mean "shell splinters." Such a weakening of the meanings of man's chosen symbols of expression may be inevitable. But, we should be careful not to reduce the appeal of the Decimal Classification, by pretending that it is a panacea, or that decimal numbers have divine attributes. Conceivably the classification may not be best for every purpose, nor decimal numbers for denoting every sequence.

It has been suggested that the U.D.C. may be made into an international language, by regarding the decimal numbers of the U.D.C. as "number-roots," which may be converted into "number-words" by coupling with them auxiliary numbers expressing grammatical functions. To distinguish the two sets of numbers, when forming a sentence, the grammatical numbers are written as exponents of the U.D.C. numbers expressing the terms.

An auxiliary table of grammatical numbers is given from which we may select the following :

- 001 Subject.
- 002 Complement.
- 043 The preceding term considered in future time.
- 063 The preceding term considered as a verb in the active voice.
- 064 The preceding term in the passive voice.

Thus, by referring to the main tables for the decimal numbers expressing the terms, the sentence :

"A medical corps will transport by cargo boat, the enlisted

volunteers, affected with asiatic cholera " would be written as :

356·33⁰⁰¹ ; 629·123·14^{003·043} ; 355·216⁰⁰² ; 616·932⁰⁶⁴.

This may be all very well. But when we go on to propose that, by changing the figures in accordance with a secret scheme, such as by writing 2 for 0, 3 for 1, 4 for 2, etc., the figure-sentence could not be disentangled, we are talking nonsense. Because such a cypher could be read very easily.

The only end, for which the Decimal Classification is essential, is for bibliographical co-operation. Whenever anyone adopts this code for any published catalogue, he, thereby, constitutes that catalogue part of a great subject index to recorded information, in which other references to its subject will certainly be found, because no single human work is complete in itself.

In the Universal Decimal Classification, as in the Dewey system, the whole of knowledge is represented by unity. The first primary decimal division, comprising all numbers between 0 and 0·1, is assigned to works dealing with general subjects that are not contained in the nine primary divisions, 0·1 to 0·9, which follow. This division contains bibliographies, encyclopædias, periodicals, collected works, etc. The remaining nine primary divisions are established as follows :

- 0·1 Philosophy
- 0·2 Religion
- 0·3 Social Sciences. Law
- 0·4 Philology
- 0·5 Pure Science
- 0·6 Applied Science
- 0·7 Fine Arts
- 0·8 Literature
- 0·9 History. Geography.

Each of these main classes is subdivided by the addition of another decimal place. For example, the class 0·5 Science is subdivided :

- 0·5 Pure Science
- 0·51 Mathematics
- 0·52 Astronomy

0·53	Physics
0·54	Chemistry
0·55	Geology
0·56	Palæontology
0·57	Biology
0·58	Botany
0·59	Zoology

Each of these classes is subdivided further as many times as may be necessary. Thus :

62	Engineering
621	Mechanical Engineering
621·2	Hydraulic power. Hydraulic machines
621·24	Hydraulic turbines :

the 0 and decimal point being omitted for convenience and the figures grouped in sets of three by other points. These points have no numerical significance and the classification numbers are arranged as ordinary decimal fractions. It will be noticed that the decimal number which represents any subdivision of any class has a definite place in the numerical sequence of all decimal numbers, and no matter how extended the subdivisions of any one class may become, the order of the decimal numbers representing the two classes on either side of it remains undisturbed.

The details of the classification must be studied in the tables. Each section of the classification is preceded by a synopsis of its main divisions, which makes it easy to locate a particular subdivision required. For instance, should it be desired to find the number for hydraulic turbines, the classifier may look at the table of primary divisions, where he will see that Applied Science is represented by 6. Turning to that section, he finds a table of secondary divisions, giving 62 as Engineering. Under 62 there is a table of its principal divisions, which gives 621, Mechanical Engineering. The synopsis under 621 gives 621·2, Hydraulic power, Hydraulic machines. Turning over the pages he comes quickly to 621·24, Hydraulic turbines.

It will be observed that the minute classification of a technical subject needs some technical training. However, like the Dewey code, the Universal Decimal Classification is

provided with an alphabetical index, from which the class to which a particular subject belongs is readily ascertained. Here the number for Hydraulic turbines is cited directly as 621.24. This alphabetical index is the means by which the users of a Catalogue or Bibliography may obtain access to the classified references. The index should not be used for classification without reference to the tables.

The sign of association. However, the complexity of the subjects, which to-day are made the themes of technical discussion, is so great that no conceivable extent of subdivision would suffice to specify them completely. But, as in thought, complex ideas are compounded of simpler constituents, so, in the Decimal Classification, the class numbers representing the simpler components of a compound notion may be combined to express it by means of a ":", which is used as the sign of association.

Thus, a paper entitled "Researches on the relation between the agricultural value of meadow grasses and their histological structure" would be classified 633.203 :581.8, where the first number signifies meadow grasses and that following the colon represents histological structure. A more complicated example might be "The influence of fertilizers on the vitamin-B content of wheat," which would be classified 631.8 :577.16B :633.11. Here the first number means fertilizers, the second vitamin-B and the third wheat. This simple method makes it possible to represent by classification numbers almost any concept. The method has the further advantage that entries may be made under the numbers reversed, or permuted, so that the information may be found from the point of view of any aspect of the subject. Thus the first paper may also be entered under 581.8 :633.203, where a histologist would look for it; and the second paper under each of its three component numbers, so that those interested in wheat and vitamins may also find the information. Strictly speaking the second paper should be entered under each of the six possible arrangements of its three component numbers. But this will not be found to be necessary except in the most extensive repertories. In practice, it may be sufficient to make only three entries, when it is convenient to arrange the numbers in cyclic order. In the

example given the numbers would be arranged in the first place

577·16B :631·8 :633·11

and entries would be made also under

631·8 :633·11 :577·16B ; and

633·11 :577·16B :631·8

keeping the order of the numbers unchanged. Actually only the first arrangement would be written by the classifier, the rearrangements being made automatically by the filing staff.

In the above example, the classification number for vitamin-B is also interesting as illustrating a method of alphabetical subdivision that is allowed in case the existing subdivision is insufficient, or where tentative alphabetical subdivisions are considered desirable. The most important applications of this principle are in Botany, Zoology, and Biography, where the Latin names of genera and the names of notable persons are used for subdivision. Thus

597·8 Rana means the frog, and

92 (Newton, *Sir* Isaac) stands for the biography of Sir Isaac Newton.

Except in special cases, the use of this method is undesirable, because it is found, in dealing with many cards, that those having numbers with alphabetical adjuncts take longer to file than those with pure numbers.

In previous editions of the Classification, the geographical numbers under 913 to 919 in the Dewey code were replaced by a series of topographical numbers (3) to (9) in parentheses, as will be referred to presently. The Dewey numbers 913 to 919 have now been restored. This makes the tables of the classification together with the sign of association practically sufficient for the use of librarians and for most bibliographical purposes.

Further devices for facilitating the classifying of ideas are :

The Stroke. This sign, /, is a shorthand device for indicating all the divisions from the first to the last mentioned. Thus 913/919 means

913+914+915+916+917+918+919.

The use of the stroke in published bibliographies is not recommended, because it tends to hide references to information, which should be indexed under each of the numbers.

The auxiliary signs and tables, and the analytical divisions. We now come to a small logical defect in the structure of the Decimal Classification, as it was first evolved by the founders of the International Institute of Bibliography. This defect was the original rules for the use of certain auxiliary classes and common, or analytical, subdivisions. Perhaps the idea was derived from the Dewey Classification, which was the first classification to be widely used in libraries. At the heads of the main classes in the Dewey Classification occurs a set of so-called Form divisions. For example, in Chemistry, 540, we have :

540·2	Text-books
540·3	Dictionaries
540·4	Essays
540·5	Periodicals,
	etc.

In each main class, the last two digits are the same for the same form division. Thus 0·2 always means Text-books. This mnemonic principle may have led to the idea that certain aspects of a subject, or of a document, may be regarded as subsidiary, or common, to a number of subjects, or documents. For a manufacturing process, there are papers, or reports, on experimental studies, raw materials, machinery, apparatus, by-products, labour, costs, premises, etc. Or, particular appliances, or machinery, may be adaptable to different purposes. Again, literature can be classified according to form, place, date or language. It does not seem to have been realized that aspects of a subject, that are subsidiary from one point of view, become of primary importance from another. And, so, a series of so-called auxiliary tables and analytical subdivisions was provided. There is no doubt that these divisions are of considerable value for private bibliographies and files, and they have been retained for this purpose. But, it is equally true that their use, in bibliographies intended for publication, tends to hide information, from their special

points of view, under any of the main divisions of the Classification, to any of which they may be attached. The idea is specification rather than classification. And there is no doubt that the inclusion of these divisions tended, by their complication, to deter librarians from adopting the Classification. Necessary restrictions to the use of these divisions in published bibliographies have now been made. These rather illogical special divisions are as follows :

(1) The sign of addition, +, may be used to signify that a document treats of two unrelated subjects, e.g. 625·1+625·7, Railways and roads. The same sense is conveyed by omitting the + sign.

(2) The hyphen was used for two purposes :

(a) For the elision of digits common to two classification numbers. For example, one 59 may be replaced by a hyphen in 591·412 :597·8 Rana ; the anatomy of the frog's heart ; giving either 591·412-7·8 Rana, or 597·8 Rana-1·412. Either of these forms may be convenient for a private specialist bibliography. Neither are suitable for a published bibliography, because they hide information about the frog under that about the heart, or *vice versa*.

(b) The second use of the hyphen was for further subdivision of groups of ordinary divisions. Tables of such hyphen divisions occur in many places. For example, under 621, where the hyphen division 621-131·1 indicates machines with vertical axles. The hyphen and following digits may be detached from those preceding it and added to any of the specified ordinary divisions. Thus 621·928·3 is centrifuges and 621·928·3-131·1 means centrifuges with vertical axles. Here we have buried information about vertical axles under that about centrifuges. And this suppression of information may happen, whenever the hyphen divisions are used in this way. In a published bibliography, we should be careful not to conceal information that may be of use for another purpose, or we lose some of the advantage of using a classification. Except in special cases, we should couple the whole

number containing the hyphen with the ordinary main number by means of the colon, as 621·938·3 :621-131·1, which is automatically reversible, giving the reference from both points of view.

(3) The analytical divisions with a nought have exactly the same defect as the hyphen divisions and should be used with the same discretion in a published bibliography. A group of such divisions was seen at the commencement of 551·51, Mechanics and structure of the atmosphere :

551·51·05	General structure
51·051	Chemical composition
51·052	Troposphere in general
51·053	Stratosphere in general
51·053·5	Heavyside layer
51·053·6	Extreme external layers.

With this group there is a note "The common subdivisions with 05 are applicable to the divisions 551·51/54 and 551·57/59," which means that the parts commencing with the zero may be added to any of the divisions mentioned. Thus, if it is desired to specify the effect of the Troposphere on terrestrial radiation, we may add ·052 to the number for terrestrial radiation, 551·521·2, as 551·521·2·052. Thus, information about the troposphere is hidden under the number for terrestrial radiation. Therefore, in bibliographies for circulation it is preferable to index the information with the colon as 551·521·2 :551·51·052 so that entries may be filed automatically under both aspects of the subject.

Thus, 668·15 :66·067·4 should be used for filter presses for making soap, and not 668·15·067·4. Moreover, many of the hyphen and nought divisions are redundant, because main numbers exist with the same meanings. These should be used in preference, according to the rules of the Classification.

It should be noted that the points are fixed in place before the 0 in these analytical divisions with ·0 and before the 00 in the analytical divisions in the sixth section.

(4) Auxiliary form divisions in () commence with a series with double zero such as (001) Statistics and (008) Patents.

In many cases corresponding main divisions exist, as 31, Statistics, and 608.3, Patents.

The auxiliary form divisions with a single nought (01/09) correspond exactly to the main divisions 01/09 and should be avoided, if possible. By their use, instead of expressing that a publication is a periodical by adding :05 to its subject number, we may substitute (05), giving 53(05) for a periodical on Physics. And we may even create new form divisions by adding any main number after (0: . . .). Thus we can indicate that a document is a manuscript by (0:091) instead of by :091, which has the additional advantage of being shorter. Similarly the use of (07) and (09), for Teaching and History, hides references, which should be numbered :37 or :93.

(5) The auxiliary stratigraphical and topographical divisions (1/9) have difficulties of their own. As we have seen, the topographical divisions are derived from Dewey's geographical numbers 913/919 by deleting the first two digits and enclosing the remainder in parentheses. To these, stratigraphical numbers (1/2) were added. For a palæontologist, such an expression as 56(44.84 :1182)4 may be convenient (or not) to specify the fossil mollusca of the Miocene of Hérault. In this somewhat involved complex, the 56 represents Palæontology, the (44.84 . . .) Hérault and the (. . . 118.2) Miocene, while the concluding 4 is derived from 594 for mollusca. If anyone is inclined to use such a combination, he should realize that a paper on such a subject may be of interest from several points of view. As, for example, the palæontology of Hérault ; the mollusca of Hérault ; the geology of Hérault ; the Miocene of Hérault ; the Miocene formation ; Fossil mollusca and the mollusca of the Miocene, and such a combination hides all these aspects, except the first. In a published bibliography, therefore, the information might be indexed 564 :914.484 :551.782.1, which means Fossil molluscs of Hérault in the Miocene formation.

But now, we have the new difficulty, which the late Mr. Lancaster-Jones first pointed out, that the geographical aspect is liable to subdivision. Similar papers might relate to France as a whole, to some other Department of France, or to another country. And so we might find papers on the Miocene, or

Fossil mollusca, under any geographical division, and we should have no one place in which to look for such a subject as the Palæontology of France, or even of Hérault. It would be hidden under any of the fossil subdivisions, or any of the geographical numbers for France and its subdivisions and mixed, under these latter, with a mass of other main subdivisions that might have topographical aspects.

The only way out of this difficulty is to restrict the addition of geographical numbers to one place in each main subject. But this, again, would be an arbitrary interference with the general rule : that *any* two numbers may be united by means of a colon. So, instead of using a colon for this purpose, it was agreed, by the Executive Committee of the Classification, that the topographical divisions (3/9) should be retained for this purpose and that their use, in published bibliographies, should be restricted to specified main divisions. So the correct bibliographical form of our compound classification number becomes : 551·782·1 : 56(44·84) : 564, with the possible addition of 55(44·84) in case there is information in the paper of value from the point of view of the geology of Hérault.

(6) There are also common analytical subdivisions with ·00, which may be combined with any of the numbers in the main tables, such as :

- 001 The Speculative point of view. Conception, aim, experimental studies.
- 002 Realization. Execution. Construction. Processes.
- 003 The economic point of view. Output. Cost and selling prices.
- 004 The point of view of service and use. Working. Management.
- 005 Fittings. Apparatus.
- 006 Premises. Establishment.
- 007 Special personnel.
- 008 Organization.

Main divisions exist which correspond to practically all these conceptions ; but these auxiliary divisions are of real service for grouping references in making administrative files.

For instance, in the paper-making industry, such items occur

as : 676 :634·983 :634·972·3, poplar tree wood as raw material in paper-making ; 676 :658·3, organisation of personnel in the industry ; 676 :662·99, heat recuperation in connection with the industry, 676 :668·41, gums as raw material in this industry ; and 676 :661·27, hydrochloric acid so used.

Putting these numbers in order we get :

676 :634·983 :634·972·3

676 :658·3

676 :661·27

676 :662·99

676 :668·41,

which is a muddle of raw materials, organization and heat processes that might be a nuisance in a file of thousands of items.

By the aid of the ·00 numbers :

·002·2 Operations of manufacture

·002·3 Raw materials, and

·008 Organisation

these numbers can be grouped in the files :

Processes

676·002·2 :662·99

Raw materials

676·002·3 :624·972·3

676·002·3 :661·27

676·002·3 :668·41, and

Organisation

676·008 :658·3.

It will be seen that there is no particular objection to the use of these ·00 divisions in published bibliographies, when the specific numbers are added after a colon, because they should be entered also after the number following the colon, except that exactly similar information may be classified by other bibliographers without the ·00 numbers.

(7) If necessary, the language in which a work is written may be expressed by means of the section of literature, 8.

E.g. 61 :84 a medical work in French. Usually the catalogue title would be a sufficient indication.

Alternatively a *table of auxiliary language subdivisions* with the = sign was established. These numbers correspond to the literature divisions 82/89, or the philological divisions 42/49, with the 8 or 4 replaced by the =. According to this notation the French medical book might be classified '61=4. The "=" is not necessary, except for the classification of dictionaries of two or more languages.

(8) Finally a *table of auxiliary subdivisions of time* is constituted by placing the date in inverted commas. Thus

" 14 " Fifteenth Century.

" 1815/1830 " The period from 1815 to 1830.

" 1932.09.02 " The second September, 1932.

There is at present no exact counterpart of this table in the main divisions.

The almost unlimited facility offered by the classification for the expression of ideas must not be allowed to lead the classifier into the error of regarding the analytical expression of a notion as an end in itself. He must ever keep in mind the principle that the aim of subject indexing is to label information so that it can be found. Everything else is secondary to this purpose. Such an expression as

526.9 :336.211.1(431)" 1927 "(075)=3,

Guide to Prussian cadastral surveying in 1927, is justly described as "Not classification but idle jesting." The essential fact to the librarian is that the publication deals with the Survey of Prussia. It would therefore be indexed

526.9(431).

Exceptionally, if the librarian's clients are specially interested in the cadastral aspect of the survey, the number for this, 336.211.1, could be added as :

526.9(431) :336.211.1,

so that the entry would be filed also under 336.211.1. No conceivable purpose is served by specifying that the book relates to the operations of 1927. This will be clear from the

title, and the entries under each classification number would also be arranged in chronological order. The addition of (075) to specify a teaching manual, and that of =3 to indicate that the publication is printed in the German language are equally futile. These additional signs mean nothing to the ordinary seeker for information and merely confuse him. Unless they assist in finding the information, the auxiliary signs should not be employed. If any of these analytical or auxiliary subdivisions must be used, the compound expression should be entered in its proper place in the working copy of the classification and an appropriate entry be made in the alphabetical index. Obviously this can be done only in a private copy and, thus, the use of these expressions is unsuitable for entries intended for circulation and incorporation in an universal index. The new rules outlined in this section are being incorporated in the English edition of the Classification now being published by the British Standards Institution.

The choice and order of arrangement of the signs and classification numbers. For a classification intended for the unification of bibliographical work, it is necessary that the same subject should be classified by different classifiers in the same way. Therefore rules for the choice of classification numbers are laid down.

In the first place a subject should be classed, if possible, under a main number. If none is available, one of the common analytical subdivisions with a single zero should be used. Failing one of these, a hyphen division should be used. If none of the latter will serve, a common subdivision with a double zero may be employed. In the last resort the tables of auxiliary subdivisions should be referred to.

The order of *preference* is then 0/9 ; .91/.09 ; -1/9;.001/.009 followed by the common auxiliary subdivisions of form, place, language and time. If there is any doubt as to the choice between two main divisions or any two divisions of the same class, the number that comes first in decimal order should be preferred.

The order of *arrangement* of the decimal numbers is the same the world over. For the arrangement of classification numbers, the analytical signs are given an arbitrary order of

sequence which is obligatory. Thus the order of arrangement of classified entries is :

+ , / , simple number, : , = , (o/9), A/Z, - , .00, .0.

3. *The Organisation of the Classification*

The Universal Decimal Classification has been gradually developed and perfected, with the collaboration of leading experts in different countries. As a whole, the Classification is some nine times as extensive as the Dewey Code, having more than a hundred thousand divisions in the main tables as compared with about eleven thousand in Dewey. Those sections that have been much used for bibliographical purposes, as in Pure and Applied Science, are much more developed. *E.g.* Organic Chemistry has two thousand entries corresponding to twenty in Dewey. Some sections may still be found inadequate. But facilities exist for making any changes that are required. The Classification is not a frozen system. From time to time whole sections may be recast in such a way as not to use the old numbers with different meanings.* This has been done in large branches of knowledge, *e.g.* Botany and Organic Chemistry. Considered suggestions for modification are welcomed. On the other hand, as the Universal Decimal Classification is intended for the unification of bibliographical work, individual modification of the scheme for published bibliographies is a bibliographical crime.

The Classification is administered by the Commission Internationale de la Classification Décimale, Willem Witsenplein, 6, The Hague, Netherlands. This comprises delegates elected by the various National Sections of the Institute, The League of Nations and certain National Libraries. Minor modifications required are dealt with immediately by a small executive committee. Requests for modifications or extensions should be addressed to the National Sections in the different countries. The address in this country is the British Standards Institution, 28, Victoria Street, London, S.W.1.

Sometimes the Universal Decimal Classification is termed "The extended Dewey." Unfortunately this description is not quite accurate. The dual control of the two systems, the

* Duyvis, *5th Report, Intern. Com. Dec. Classification*, 1931.

Dewey Classification being administered separately by the Educational Foundation, Lake Placid Club, N.Y. State, U.S.A., has led inevitably to the introduction of some discrepancies. Arrangements have been made to eliminate these, as far, at least, as the first three figures, and the changes are being incorporated in the English edition.

The use of the Classification. The Universal Decimal Classification is designed for use in the collection and dissemination of information on any subject, or any subdivision, however detailed, of any subject. One of the main purposes of the classification is for the indexing of published bibliographies. All contributions to bibliography classified by this system can be amalgamated into a single index, irrespective of source or language, and thus all bibliographers who use the Universal Decimal Classification contribute to a universal index to knowledge.

The following example of an abstract, taken from the *Power and Fuel Bulletin*, shows the standard arrangement of the bibliographical entries with the decimal number of the Universal Decimal Classification printed in the top left-hand corner in conspicuous type.

621.222

1932.01.08. Some Large Pelton Wheels.

Engineer Vol. 153. 1932. pp. 45-50.

[Particulars are given of four large hydro-electric Pelton wheel units which have just been constructed. Each of these machines is of 17,000 horse-power; they are claimed to be the largest single-runner Pelton turbines ever made in Great Britain. They work under a head of 2,000 ft. at 428.5 r.p.m. The wheels are overhung and various other special features of design are embodied in the valve and governing mechanism. Stainless steel is largely used in the construction and the plant throughout is automatically controlled, both mechanically and electrically, by an oil pressure and servo-motor system.] [33]

The number in [] at the end of the abstract is the serial number of the abstract in the *Bulletin*. When the abstract, or reference, contains information that cannot be represented by

UNIVERSAL DECIMAL CLASSIFICATION 43

a single decimal number, more decimal numbers are added in the same position, as shown :

66·266 :541·126

622·814

GODBERT, A. L., and WHEELER, RICHARD VERNON

1932·01·22. The Combustion of Coal Dust

Safety in Mines Res. Board. LONDON. Paper No. 73.

Reviewed in *Colliery Guard*. Vol. 144. 1932. p. 168.

[The research described in this paper is supplementary to the study of the relative inflammability of coal dusts (Paper No. 56), and affords an explanation of some of the findings of that research. The researches show that the initial ignition of a coal dust is determined by the reactivity of its ulmin material and by the proportion of highly inflammable non-ulmin material it contains.] [19]

These numbers have the following meanings in the classification :

662·66 Coal and anthracite as fuel.

541·126 The physical chemistry of spontaneous reactions, explosions, reaction regions.

622·814 Prevention of coal dust explosions in the industry.

The first two numbers compounded by the colon indicate that the information is concerned with the subjects specified by these numbers in relation to one another, while the third simple number indicates that the paper refers to another aspect of coal dust explosions, which is not mentioned in the abstract. It will be noticed that the Universal Decimal Classification numbers express the nature of the information in a concise and accurate manner. Experience has shown that abstracts cannot always be relied upon to give sufficient information for assigning the correct decimal numbers, and this indicates that, frequently, the decimal numbers are more accurate representations of the information contained in the original papers than the abstracts themselves. It is necessary to assign the decimal numbers after perusal of the original papers rather than the abstracts. The Decimal Classification will not absolve the classifier from thought, but it will assist him to arrange his ideas and thus conduce to accurate thinking.

Classification is an art, requiring knowledge of the schedules themselves, and also, above all, of the subject to be classified. It is necessary that the classifier should keep in mind always that the aim is not to specify the contents of a particular document, but to be able to produce all the documents relative to a particular aspect of a subject when required, from whatever source they may have come, and by whoever they may have been classified. The classifier must continually ask himself from what point of view the information indexed is likely to be asked for.

When experts first come into contact with the schedules, they are, frequently much impressed with the extreme facility, offered by the numerous analytical subdivisions for expressing the exact contents of a paper. They specify its subject by means of several analytical divisions, without reflecting that they have certainly hidden information from several points of view and that perhaps the paper may be the only one which has exactly the expressed characters. The aim of the classification is not to specify the contents of a single paper, but to bring together references to all papers having such characteristics in common.

For example, a laboratory investigation on the synthesis of gaseous ammonia under high pressure could be specified :

546·39-13·07·034·2,

where the 546·39 means ammonia, the -13 indicates the gaseous state, the ·07 synthesis, and the ·034·2 means high pressure. In this expression we have specified the subject of the paper beautifully. But, if anyone wants to find it from the point of view of gases, synthetic reactions, or the use of high pressure, he can do so only by searching carefully a complex of analytical numbers under each main heading of inorganic chemistry. Preferably we should use the analytical numbers in their undivided forms, as they occur in the tables. Thus :

546·39 :54·13 :54·07 :54·032.

But, actually, there are main numbers for two of these ideas :

542·7 manipulation of gases, and
542·91 synthesis.

These numbers should, of course, be used instead. Further consideration suggests that the fact that ammonia is a gas is not of great importance. This is, also, contained in the idea of the use of high pressure. So we get finally :

$$\begin{aligned} 546\cdot39 : 542\cdot91 \\ 546\cdot39 : 54\cdot034\cdot2 \end{aligned}$$

as a sufficient and complete classification for the paper. Cards would be filed automatically by the unskilled staff also under

$$\begin{aligned} 542\cdot91 : 546\cdot39 \text{ and} \\ 54\cdot034\cdot2 : 546\cdot39. \end{aligned}$$

In this way we have filed references to all the information recorded in the paper.

Experts may be inclined to say, at first, that shades of meaning can be expressed by the analytical numbers, different from the more general meanings of the numbers in their undivided form. Thus all the three different expressions following have different meanings :

661·728-498·1 : 66·062 means solvents for liquid cellulose.

66·062-498·1 : 661·728 means liquid solvents for cellulose.

661·728·062-498·1 means cellulose as a liquid solvent.

It is necessary only to write out the meanings to discover that two of these numbers are irrelevant. The practical classification for such a paper would be simply :

$$661\cdot728 : 66\cdot062$$

cellulose solvents.

When even more analytical numbers are used, the complications become extremely great. We have only to add ·0014, signifying tests, to see how confusing the further combinations may become. If we realize that these combinations of analytical numbers may occur under almost every main subdivision of the tables, we are obliged to ask ourselves what purpose their employment can possibly serve.

It is possible to simplify the expressions considerably by attaching only one analytical division to a main subdivision at a time and using the others in their undivided form. Suppose

we are concerned with making steel strips and steel plates by the processes of cold and hot rolling. We might make use of the numbers :

669·14 steel
 -122·2 cold rolling
 -122·4 hot rolling
 -418 strips
 -419·16 sheets.

We should then get such expressions as :

669·14-122·2	:669-418	cold rolling steel strips	
669·14-122·2	:669-419·6	cold rolling steel sheets	
669·14-122·4	:669-418	hot rolling steel strips	
669·14-122·4	:669-419·6	hot rolling steel sheets.	
669·14-418	:669-122·2	} With similar meanings.	
669·14-418	:669-122·4		
669·14-419·16	:669·122·2		
669·14-419·16	:669·122·4		

In this way we do collect under steel, cold rolling, hot rolling, strips and sheets, the information recorded about these respective ideas. But the whole rigmarole will be repeated under each of the alloys of steel and even under many other metals. And we must not forget that there are a great many other analytical divisions which may come under each heading, as well as the four selected. Is not the information found more easily if it is classified, not specified, simply as :

669·14 :669-122·2
 :669-122·4
 :669-418
 :669-419·6,

a card being placed in the index also under each number reversed.

And, after all, we must not forget that all other bibliographer will certainly not use these complications. And so, we shall have the same information specified in many different places.

It has been suggested that analytical expressions such as 661·728·062-498·1 might be used with underlining of the ·062 and -498·1 to indicate that cards should be filed also under

66·062 and 66-498·1. But such work would be quite beyond the capacity of the unskilled staff employed for intercalation in a large index, comprising many million cards. To employ skilled staff for such a purpose would be unthinkable.

When we realise that it is almost impossible to memorise these complicated expressions, and that they are most laborious and time wasting to file, we are forced to the conclusion that they are unsuitable, except for private files.

On the other hand, the classifier should not hesitate to use as many simple decimal numbers as are needed to express the different aspects of the document.

It is not necessary that users of the system should invariably employ the minor subdivisions designed for specialists. An abridged system without the auxiliary tables will suffice for many purposes. Those librarians who collect published bibliographies classified by the Universal Decimal Classification, to render information in their books more accessible, or who use the system for the preparation of their own indexes, may find it convenient to arrange their books also according to the same method. In using the Universal Decimal Classification for this purpose it is advisable to employ only the major subdivisions. Too great detail in classification on the shelves is confusing to the searcher and leads to books being replaced wrongly. The greater flexibility of the system removes some of the objections that have been made to the use of the Dewey system. For instance, Biography can be treated as a separate class and arranged alphabetically. Nor is there so much objection as has been alleged to the separation of main subjects such as Latin language and literature, which, to some, seem closely allied. It is possible to bring such sections together on the shelves, displaying notices to advise the public.

The logical sequence of the main divisions of the Classification has been criticised often. Several elaborate classifications have been devised as substitutes, by authors who have failed to realise the fundamental principles of bibliographical classification. Not one has been used for classifying any extensive series of published bibliographies. The Universal Decimal Classification remains the only classification, sufficiently elastic and extensive, for indexing literature as a whole. And its success has been so great that, of a total of 250,000

different scientific articles catalogued annually before the war, nearly half received decimal classification numbers. Now, the Classification has attained the decent age of more than fifty years. It is no longer "new," and yet it is for ever young, because it has an active gland that keeps it always up to date. The Classification has now been dignified as a British Standard by the British Standards Institution. We look forward, in confidence, to the realisation, in the near future, of a complete subject index to scientific papers, through the co-operation of experienced abstracting institutions, covering all the literature.

The Relative Index. An important part of the Universal Decimal Classification is its so-called Relative Index. The purpose of the index is to facilitate its consultation by the general public. When the Classification was adopted in the Science Library the need was felt of an alphabetical index to enable readers to find quickly the numbers under which information relevant to their enquiries had been indexed. There was no English edition of the classification available and consequently not even an alphabetical index in English. So one was made by writing the names of the subjects indexed on cards and keeping the cards in alphabetical order. These entries were prepared by a number of cataloguers and, in consequence, a set of rules had to be evolved to ensure that the different cataloguers would make similar entries for similar ideas. After considerable experience, the rules were first published in a joint paper by Professor Pollard and myself, entitled "The preparation of indexes to publications classified by the Decimal Classification" presented to the Annual Conference of the Association of Special Libraries and Information Bureaux, the rules have subsequently been adopted by the British Society for International Bibliography.

CHAPTER IV

THE PREPARATION OF SUBJECT INDEXES TO VOLUMES OF PERIODICALS

We come now to one of the uses of the Universal Decimal Classification as a great labour-saving device.

We may look at the problem of making subject indexes to volumes of periodicals in two ways : (i) from the point of view of the editors of the journals and (ii) as users of the periodicals ourselves. For the sake of the editors, we may ask, what system, if any, will reduce the labour and expense of compilation, not merely of indexes to single volumes, but also of indexes to a number of volumes ? The most economical method of making the index is, also, that best suited to satisfy the needs of the reader.

It is important to have the clearest idea of the nature of the reader's wants. For what purpose does he use the index ? (i) He may remember to have seen a particular article recently, to which he wishes to refer. (a) He may recollect the author's name. (b) He may imagine that he knows the title of the article, or (c) more likely, he will remember that the article was about a certain subject. These are the three recognized main classes of inquiry, for which an index may provide. Usually we attempt to answer only the first and last type of question, *i.e.* the author and the subject inquiry. (ii) There is another type of reader, who may wish to know, if the journal may contain, in any volume, information that he needs. The annual index is intended for the first type of reader, and the index to a number of volumes is designed for the second type.

Now, we know that the number of original articles and papers published annually is enormous. In science and technology alone this number has been estimated to amount to three-quarters of a million, of which about a quarter of a

million are indexed in current bibliographies. We are faced immediately with the problem that all the information on a particular subject may not be contained in a single volume of a periodical, nor even in a series of volumes of that publication. In the field of science and technology, there are some fifteen thousand current periodicals containing useful articles. It has been shown that any one of these periodicals may contain information relative to a particular topic, at some time during the course of publication of the journal, and that, perhaps, as much as one-third of the information, recorded on a particular subject, is scattered in periodicals only remotely, or not obviously, connected with that subject. The question arises: should the index to a periodical be designed entirely from the point of view of that periodical, or, should there be some coordination with the indexes of other periodicals? Perhaps we can agree that, other things being equal, there is at least no harm in this.

We know, also, that, on account of the difficulty of ascertaining what has been recorded on a particular subject, there exist so-called Abstracting Journals, which collect together, and make abstracts of, information published on particular subjects. These journals, also, need to be indexed. Is there any essential difference between the indexes to these journals and those of ordinary periodicals? Perhaps not.

The form adopted, in most cases, for these indexes is the alphabetical arrangement of combinations of words chosen to denote the subjects of the articles. All things considered, is this the best form? Information may be recorded in any language, and the same idea may be denoted by a great variety of different words, differently combined. In practice, all indexes constructed in this manner are so different, that it is impossible to bring any of them together into a single series. Each one must be kept and searched separately. The labour of search would be great enough, if each abstracting journal contained references to all the information recorded on the subject, with which it deals. We know that this is not the case. Moreover, any abstracting journal may contain references to information about any subject. In practice, we select a number of the most likely of these abstracting periodicals and search all their indexes, one by one.

The labour of this search is increased by the fact that, besides being different in construction, the alphabetical arrangement of subject words necessitates reading each index through from beginning to end, in order to find where the references to a particular topic may have been hidden by the indexers. This is a sweeping statement. In the author's experience it is literally true. Further, this arrangement makes it impossible to answer an inquiry for information on a group of things, *e.g.* a new class of sugars ; because the items of information are indexed under the names of the members of the group, and, without knowing beforehand part of the information sought, *i.e.* the names of the members, it is impossible to find what has been written about them.

The realisation of these difficulties has led, as we have shown before, to the adoption, in alphabetical indexes, of concealed classifications, which are unknown to the reader, always incomplete, differ entirely in each journal, are burdened with a mass of irritating and time-wasting cross-references, have to be modified from time to time, and seem always to be different in indexes to a series of volumes from those adopted in the annual volumes. The fact that such concealed classifications are needed is, in itself, a sufficient indictment of the alphabetical method. The disadvantages of this method are due to the fundamental fact that we want to index *ideas*, which are not words and have no alphabetical order. They can only be classified.

Would it not be a simplification to give up the attempt to combine the incompatible ideas of classification and alphabetical arrangement and boldly make use of the classification we have hidden hitherto ? True that the imperfections in our home-made classification will be exposed. But that difficulty can be surmounted by using a comprehensive classification, such as the Universal Decimal Classification. Would it not be an enormous saving to the reader, to know where to look in every periodical for the references he requires and to have those he wants collected together for him ? Would not the work of preparation of the index be simplified and reduced ? New headings, with their dependent cross references, would not have to be thought out, the procedure would become automatic and could be relegated almost wholly to properly

qualified minor staff. The same index entries would be sufficient both for the annual index and for that to a number of volumes.

Shall we see how this works out in practice? To prepare the index to a volume of the periodical, the titles of the articles or abstracts in the separate numbers of the volume are copied on to cards, or slips, of uniform size and provided with decimal classification numbers, one number for each subject dealt with, and the relevant page and volume numbers added. These cards form the material for the index. They are, in fact, just ordinary bibliographical references, classified by the Decimal Classification.

The simplest method of using the material is to arrange it in numerical order of the classification numbers and print it. This method was first used by Prof. A. F. C. Pollard in the twenty-five years index to the *Transactions of the Optical Society*. Here is an extract :

DECIMAL-TITLE INDEX

- | | | |
|--|---|-----------|
| EDRIDGE-GREEN, F | W | 535·733·1 |
| 1909.10.21. The theory of vision and colour perception.
<i>London, Trans. Opt. Soc.</i> 11 1909-10 (10-25). | | |
| DRYSDALE, CHARLES V | | 535·733·1 |
| 1913.11.13. Some new optical instruments.
<i>London, Trans. Opt. Soc.</i> 14 1913-1914 (19-39). | | |
| DRYSDALE, CHARLES V | | 535·733·3 |
| 1913.11.13. Some new optical instruments.
<i>London, Trans. Opt. Soc.</i> 14 1913-1914 (19-39). | | |

Such an index is a valuable contribution to bibliography, because it can be cut up and mounted for intercalation with items from similar indexes, and any bibliographical notices similarly classified, to form a general index to a subject, or to the whole of knowledge.

The only skilled work needed in the preparation of this form of index is the application of the decimal classification numbers to the articles, which is not more difficult, or lengthy, than using the concealed classification.

A similar form of index has been adopted also for the *Proceedings* of the British Society for International Bibliography,

and was used by Dr. Priestley for *Physiological Abstracts*. I give an example of the former.

ANOTHER DECIMAL-TITLE INDEX

41·3

WHARTON, LEONARD CYRIL

1941. Some aspects of terminology.

Proc. Brit. Soc. int. Bibliogr. Vol. 2. 1940-41. Pt.4. 1941.
pp.69-72.

491·7/8 :41·115

WHARTON, LEONARD CYRIL

1940. On Prof. Damiani's scheme for the transliteration of titles in the cyrillic character.

Proc. Brit. Soc. int. Bibliogr. Vol. 2. 1940-41. Pt.1. 1940.
pp.5-11.

62(083·7)(061·5)

STANLEY, JOHN FRANK

1941. Standardization and the work of the British Standards Institution.

Proc. Brit. Soc. int. Bibliogr. Vol. 2. 1940-41. Pt. 4. 1941.
pp.57-67.

631·4(061·5) :025·45

JACKS, GRAHAM VERNON

1940. The use of the Universal Decimal Classification at the Imperial Bureau of Soil Science.

Proc. Brit. Soc. int. Bibliogr. Vol. 2. 1940-41. Pt. 3. 1940.
pp. 49-56.

For use with such indexes, a small manual is needed, which contains those sections of the Decimal Classification that cover the field of the periodical, together with an alphabetical index to the classification numbers. The reader ascertains, from the manual, the decimal number, or numbers, corresponding to the subject of his inquiry, and these numbers are the same in every volume of the periodical and of every periodical, in every language, using the same system. Such a manual is printed once for all and needs only to have added any new classification numbers that are necessitated by the progress of knowledge.

Instead of printing a manual, it is possible to include in each volume of the journal an alphabetical index to the decimal numbers actually used in the volume. This is made automatically, by cutting up and mounting on a card, each item from the alphabetical index to the relative portions of the classification. These cards are arranged and kept in decimal

order. Such a reversed alphabetical index appears like this :

REVERSED ALPHABETICAL INDEX

- 621·187·127 Feed-water, Purification, Electrical
 621·187·128 Feed-water, Purification, Chemical
 621·187·13 Feed-water, Apparatus
 621·187·131 Pumps, Feed-water
 621·187·131·018·2 Pumps, Feed-water, Efficiency
 621·187·14 Feed-water, Heating
 621·187·142 Economisers, Boilers
 621·2 Power, Hydraulic
 621·209 Power, Hydraulic, Utilization
 621·21 Water-mills

In making the alphabetical index to a particular volume of a periodical, those cards are selected that have the same decimal numbers as those given to the articles in the periodical. These cards are then rearranged in alphabetical order and printed. Such an alphabetical index was adopted by Sir Frederic Nathan for the *Power and Fuel Bulletin*. It appears like this :

ALPHABETICAL CLASSIFICATION INDEX

Boilers

- Cylindrical 621·181·4
 Fire-tube 621·181·3
 For waste heat 621·181·62
 Marine 621·181·162
 Heating of 621·182
 High pressure 621·181·174·1
 Insulation 621·186·4
 Lancashire 621·181·33
 Marine 621·181·1
 High pressure 621·181·1·174·1
 Water-tube 621·181·15
 Steam engines 621·18
 Thermal studies 621·18·016
 Types 621·181

Brakes

- Electric
 Recuperative 621·316·719·3
 Electric vehicle
 Recuperative 621·337·522

Some editors will be saying that such a decimal-title index is impracticable, on account of the greater space it takes up than

the alphabetical index and the consequently increased cost of printing.

What would they say to this ?

CONDENSED DECIMAL-TITLE INDEX

- 535·317. A criticism of the nodal slide as an aid in testing photographic lenses, 23, 188. A simple direct method of testing spherical and cylindrical lenses, 1, 72.
- 535·318. On the Berthonian system of standardising astronomical eye-pieces, 4, 41. On a fluor-glass concentric eye-piece for high powers, 15, 183, 202. On the design and testing of telescopic objectives, 18, 142, 196.
- 535·319. The path of rays in periscopes having an inverting system, comprising two separated lenses, 23, 24. The optical three apertures problem, 23, 132. A projective treatment of the submarine periscope, 23, 217.

Here the space is reduced by bringing together all the entries having the same classification number. In this particular example, author's names and dates have been excluded and the references to page and volume numbers simplified. In all these subject indexes, editors and readers will appreciate the convenience of having all the references to articles on the same topic in the same place and adjacent to articles on similar subjects. At the same time, irritating and time-wasting cross-references are abolished.

If this last form of index is still not short enough, this is still shorter :

DECIMAL-REFERENCE INDEX

551·52	P375
551·524	P333
551·53	p318
551·56	p222, 240, 329
551·569	p240
551·57	P344
551·573	P333
551·576·12	p316
551·578·46	p366
551·583	p313
551·583·79	p333
551·584	p318
551·586	p306

It is prepared by copying on to cards, only the classification numbers of the articles, together with their page numbers and

printing these alone. For annual indexes it is sufficient in most cases to quote only one decimal number in each index entry, repeating the page number under each classification number if there is more than one to an article. Certain exceptions will be prominent, which include many page references under one decimal number. These are met automatically by the general rule, that entries having more than a certain number of page numbers, *e.g.* six, should be subdivided, by quoting a second decimal number. This method is used in the *Half-yearly Index to the Science Library Weekly Bibliography*. All these indexes are used with a copy of the decimal classification or an abbreviated manual.

Various other modifications of the classified index are possible. For instance, the meanings of the decimal numbers may be inserted after them, like this :

DECIMAL-REFERENCE INDEX

with meanings of the numbers

536·21	Heat conduction, in solids. I 812
536·46	Combustion, Physics. I 562
536·51	Temperature, Measurement, Change of State. I 565
536·52	Pyrometry. I 87, 528, 529
536·521	Pyrometry, Optical. I 821
536·53	Temperature, Measurement, Electric. I 814
536·532	Thermo-couples. I 528, 529
536·6	Calorimetry. I 780

This index is similar to that used by Dr. Hudson in *Plant Breeding Abstracts*. It is shorter than that giving the titles of the articles. Consequently it is cheaper to print. Can it be denied that all these classified indexes are easier to make and use than alphabetical indexes ?

It may perhaps be interesting to add that the Decimal Classification can be used to produce an alphabetical index in much the same way as any concealed classification. This is done by striking out the decimal numbers from the preceding index and rearranging the terms in alphabetical order. The result is as follows :

ALPHABETICAL SUBJECT INDEX

Calorimetry	I 780
Combustion, Physics	I 562
Dielectrics, Influence on	I 437

SUBJECT INDEXES TO PERIODICALS 57

- Electric discharges in rarefied gases I 432
- Electricity and magnetism, Physics I 455
- Electricity, Physics I 764
- Entropy I 90
- Heat conduction, in solids I 812
- Heat, Latent I 21
- Heat of combination I 12
- Magnetism, Physics I 764

Here again skilled work is eliminated, except for the classification of the articles. The advantages of the classified index are lost, information on the same subject is scattered and, either cross-references must be added, or the page numbers repeated under the various synonyms in the alphabetical index to the classification. The index has this advantage, however, that, in being based on the Decimal Classification, it is uniform with that of all publications using the system. And, provided that the alphabetical index entries are taken without alteration, it is possible still to utilise the references, by adding the decimal numbers automatically, for addition to a cumulative card index, comprising references from all bibliographies using this classification.

CHAPTER V

GENERAL ABSTRACTING SERVICES

ALTHOUGH the beginnings of documentation may be traced to the earliest catalogues of printed books, and the first catalogues were classed catalogues, the real commencement of the art of documentation was the appearance of periodicals designed to give abstracts of current scientific literature. As we have indicated, the first of these was the *Pharmaceutisches Centralblatt*; this began in 1830, while library technique was still in process of development. From that date, the abstracting services have gradually extended, until, to-day, they produce, together, as many abstracts as there are different articles to be abstracted. Most of these abstracting periodicals have arisen from the wish of certain scientific societies to keep their members informed of work, published by other agencies, relating to the subjects within the field covered by these societies. In a paper on "British Abstracting Services" contributed to the fifteenth Ordinary Meeting of the British Society for International Bibliography in April, 1940 (*Proceedings*, Vol. 2, p. 33), Dr. J. A. Wilcken quotes Dr. Siemens, first President of the Society of Telegraph Engineers, the predecessor of the Institution of Electrical Engineers, as saying "The idea of a practically useful Society of Telegraph Engineers could not be realised without the publication of carefully edited transactions comprising not only the subject-matter of papers that may be brought before us from time to time, but of all matter of scientific or technical interest relative to Telegraphy that can be brought together." We note the "all" as showing that completeness was regarded as important, even at that early date. Thus the Society began to publish abstracts of papers from other journals. From 1898 the abstracts section was published separately as *Science Abstracts* and actually

amalgamated with the abstracts published by the Physical Society. The President expressed his fear that some members might resent the sacrifice of "a monopoly," but hoped that sentimental reasons might not be allowed to hamper progress. We see the beginnings of a movement towards amalgamation. Since then, although that urge has several times been manifested, it needs a definite stimulus from such a body as the International Federation for Documentation. In the words of Dr. Wilcken, "speaking on behalf of the Institute of Electrical Engineers . . . if we are to carry out the recommendations of Dr. Siemens . . . it is obvious that nothing but a properly coordinated effort can avail. How could we, otherwise, ensure that (1) every scientific article of importance is duly classified, abstracted and the abstract published, that (2) the abstract is made easily accessible to anyone interested, and (3) that as little waste as possible is incurred?"

It is essential to realise, at the outset, that abstracting services are of two kinds: (1) the general abstracting services performed by the large abstracting bureaux, such as *British Abstracts*, *Science Abstracts* and the abstracts published by the Imperial Agricultural Bureaux, and (2) the special abstracting services, carried on by individual information services of large business firms from their more particular points of view. The general service is intended to cover the whole field of a particular science or group of sciences. It cannot notice all the minutiae of every paper, any one of which may be of special interest to a business technician. The purpose of the general abstract is to describe the main purpose of each paper: according to the type of paper, it may, or may not, be a complete abstract.

The general abstracting service brings to the notice of the specialist all the papers that contain information relating to the special field in which he is interested. The abstract may serve to show that a paper is not likely to contain information of importance from his special point of view, in which case the abstract saves him the trouble of reading the paper. Conversely, the abstract may indicate that the paper is likely to contain information he will want to see. Then the specialist must procure and read the paper. For example, an investigator, working on the theory of solution, from the point of

view of molecular attraction, would discover, from the indexes to the subjects of the abstracts, several thousands of papers on the theory of solution. The abstracts of these papers will then show that only, perhaps, a hundred papers deal with the attractions of the molecules. The investigator must read these hundred papers, and the abstracts save him the trouble of looking at the others.

In fact, the general abstracting service aims at doing three things : (1) to give a survey of current work ; (2) through its annual and decennial indexes to introduce the research worker to all work bearing on his special subject, and (3) to enable him to select for intensive study, only those papers that are written from his particular point of view.

The special abstracting services attempt to pick out those papers that contain information on the particular small matters in which the institutions they cater for are, or may be, specially interested. In this chapter we deal only with the general abstracting services, leaving the special services to be dealt with in chapter VII.

The first question for a general service is how to pick out from the mass of 15,000 useful current periodicals, containing three-quarters of a million useful papers, those papers which record useful information appertaining to the science, or group of sciences, covered by the service. We have seen that this is an impossible task for any single agency, as at present constituted. An agency can take only a group of periodicals more particularly devoted to its particular science or sciences, abstract all the articles of interest to its clientele, pass on to other agencies all articles not within its scope, and receive in return, from these other agencies all other articles within its purview. As almost all the useful periodicals are received by one, or other, of the aggregate of abstracting services, and all should be, every useful article should be brought to the notice of an agency. In course of time such a reciprocal arrangement will doubtless ensue.

The accessions register. The internal working of a service begins with the recording of each part of each periodical received. For preference, the accessions register is maintained in cards, may be, on the visible index system. Each

card should show the name of the periodical, how it is acquired and from whom, when the account, if any, was paid, the year of publication of each volume, the volume number and the number of each part, the date of receipt, the name of the abstractor, when the part was sent for abstracting and when received back, or whether it was sent to another abstracting bureau.

Another register may be kept of the contents of each number of each periodical, with the name of the author of each paper, its title and page numbers.

The author register. A separate file is needed of the names of the authors of all the articles dealt with. This should give the titles of their papers and the name of the periodical containing them. This file is useful for tracing whether, or when, a particular article has been dealt with. It is used also for the preparation of the author index to the volume of printed abstracts.

The Abstract should vary in form according to the kind of paper abstracted. This may be (1) a general discussion needing only a record of the title of the paper and the subject of discussion. (2) The paper may be a survey of the present state of a subject, or may give an historical outline of its development, or it may be a summary of the methods of treatment available, of its applications, or of the results attained. In this case, the abstract may be restricted to the name of the subject summarised and the object of the survey. Other papers (3) may give descriptions of some pieces of apparatus, a machine, or installation, some engineering work, or the properties of materials. The abstract must give particulars of the salient features. Or (4) the paper may contain records of some new experiments, or theoretical investigations, in which case, the abstract should, if possible, but often does not, contain sufficient information for the investigation to be repeated.

As an instance of this latter kind of abstract, the author well remembers one, describing a new apparatus for determining vapour densities and quoting the results obtained. He was particularly interested in the vapour density of ethyl ether below the boiling point, the figures quoted did not tally with

those cited in the usual tables for temperatures above the boiling point. The author found that the abstract was almost as long as the original paper, when he came to look at it, and almost the only point the abstract did not mention was that commercial sulphuric ether had been used for the experiments.

When the abstract has been written, it needs careful revision by the editor, to delete all redundant words. A very few words saved in each abstract may be the means of saving reams of paper in the annual volume of the abstracts.

Classification. When the abstracts have been prepared, they have to be arranged in some way, for the convenience of readers, so as to bring together abstracts of papers relating to the same subject and to similar subjects. Many abstracting services still cling to the alphabetical arrangement, to the disadvantages of which we have referred already. When the Universal Decimal Classification is adopted, the advantages to readers and the saving of labour and editorial work in the preparation of indexes are enormous. The work becomes almost entirely automatic, once the decimal numbers have been added, and can be carried out by the unskilled staff.

The Universal Decimal Classification is the only comprehensive system which is adequate for the classification of abstracts. All the criticisms levelled against it will be found, on closer examination, to apply to any classification. Its advantage is that every abstract can be classified, thereby, exactly. And, by its use, all abstracts, produced by all the agencies, which employ the method, can be brought together into a single index to recorded information.

To assign the correct classification numbers to many thousands of current abstracts, needs both a thorough knowledge of the classification and considerable acquaintance with the subjects treated. With sufficient technical training in the subjects of the articles, knowledge of the classification is rapidly acquired, and, very soon, in most cases, the articles can be classified without reference to the schedules. But articles cannot be classified from their titles alone. Careful reading of each article is necessary. When classified, the abstracts are brought together in the order of the decimal numbers and each abstract is given also a serial number. The classification

numbers constitute, also, the material for the preparation of the annual and cumulated indexes to the published volumes, thus saving almost all the skilled work involved in their preparation.

The Preparation of Indexes. For this work, subject index cards are prepared which bear the classification numbers of the abstracts, the names of the authors of the papers, the titles of these papers, the serial numbers of the abstracts, and the names of the journals in which they appear, with their volume, part, and page numbers. A set of alphabetical index cards is made of the actual terms of the classification, corresponding to the classification numbers, as described in Chapter V. These cards are arranged in numerical order. The subject index cards are also put into numerical order. To each group of cards having the same number, is added, from the alphabetical index set, the appropriate card having the same number. Each group of cards has then its appropriate alphabetical subject heading and is made into a single bundle with an elastic band. When this has been done, the bundles are rearranged alphabetically and the alphabetical index is ready for the printer. After printing, the copy is retained and added to, in alphabetical order, as each annual index is printed. In five, or ten, years time, the copy is ready for the quinquennial, or decennial, index, without further alteration. Could anything be simpler?

A subject index is made, just as easily, by rearranging the subject cards in numerical order. It can be used with a printed extract of so much of the full schedules, as contains the subjects dealt with by the abstracts. This extract may be printed, once for all, and needs only the occasional addition of new terms employed. Or, if desired, a simpler alphabetical index may be made to only the terms used in the extract from the schedules. This is used with the subject index to each volume.

CHAPTER VI

THE ORGANISATION OF A LIBRARY SERVICE IN SCIENCE AND TECHNOLOGY

Introduction. The variety of type of the libraries included within the scope of this chapter is considerable, including, as it does, the libraries of scientific societies, business firms and research institutions of all kinds, as well as public libraries and special libraries designed for, or consulted by, industrial organisations. As the forms of business enterprise are multifarious, so also are the types of library intended to cater for them. These have indeed one attribute in common in that they exist for the purpose of supplying information and, on their efficiency in this respect, their usefulness depends. Such libraries may be divided into two kinds, *i.e.* those that deal with the technical problems of manufacture and those concerned more particularly with the commercial aspect of selling and distribution, although there is necessarily much overlapping in the literature collected in these classes. Attention will be directed not to the details of the working of such libraries, large or small, but only to the general problem of organising an efficient library service. The organisation of Special Libraries will be studied in the next chapter.

Certain facts and tendencies need emphasis as a preliminary to the study of this question.

1. The primary published records of progress in science, and in the applications of science to technology and industry, are contained, almost exclusively, in periodicals. Books and journals purporting to review such advances can only summarise somewhat inefficiently the main channels. For adequate detail the scientific worker must refer to the original records.

2. Scientific and technical literature, especially periodical publications, cannot be divided into water-tight compartments. Not only are papers on any one special subject scattered throughout the literature of all science, but any individual paper may be of importance from several points of view. *E.g.* it is not possible to separate the publications relative to pure science from those that deal with applied science ; nor to collect in one place the literature that is of importance only from the chemical point of view. Even were all books and periodicals dissected into chapters and single articles, it would still be impossible to say of any item that it had importance only from the point of view of one special subject.
3. The extent of this interpenetration and mutual relationship is so great that the publications more particularly devoted to a given question contain less than half the information relative to that question, the remainder being scattered throughout the general mass of scientific literature.
4. Thus, libraries devoted to special branches of science tend to acquire a large miscellaneous collection of literature on related subjects, or of general scope, which can never be complete. This leads to the ineffective duplication, to an increasing extent, of publications in the stock of other libraries of different nominal scope.
5. Consequently special libraries are unable to collect that larger portion of the information on their special subjects, which is scattered in thousands of periodicals on other subjects. And, by reason of limited staff and funds, such libraries are often prevented from keeping properly in touch with the increasing extent of the special literature in their proper fields. They do not acquire those periodicals which are relatively inaccessible, or which for one reason or another they regard as unimportant. Frequently this means that they ignore the more expensive records, or those in the less common languages, or those scattered through a large number of minor bulletins and journals.

6. As a result of all these tendencies, which even a cursory scrutiny of the successive editions of the World List of Scientific Periodicals shows to be active, there is evident in the aggregate representation of the libraries of *e.g.* Great Britain, a considerable lacuna in the total output of published records, coupled with an equally considerable duplication of representation of the more readily accessible periodicals.
7. The same considerations involve a corresponding deficiency in the publications that attempt to abstract the literature of special subjects. This is fully confirmed by analysis.
8. To these difficulties are added widespread restrictions on the loan of books, which necessitate travelling from one library to another and make adequate consultation of the available literature almost impossible to readers in the provinces.

The mere statement of these facts is sufficient to show that the efficiency of all kinds of special libraries depends on the existence of facilities for co-operation with other libraries. In the sequel, after certain preliminary considerations, it is shown that a solution of the problem exists in the development of one of the great libraries of a country as a national central library of science and technology, with definite functions. It is also shown that the cost of this development is relatively small and the gain in general aggregate efficiency very great.

This does not imply any interference with the organisation and development of existing special libraries. It becomes clear, however, that their proper function is to make themselves as complete as possible in the literature and information within their limited fields, relying on a central library for articles, and references to information, contained in publications on border-line and cognate subjects.

Inquiries should be directed in the first instance to the special libraries specially concerned with their nature. Only when the information available in such libraries is found to be inadequate, or when the inquiry concerns several, or wider, branches of knowledge, should reference be made to the central library.

Function of a General Library of Science. Some misapprehensions as to the proper functions of great libraries appear to exist. An impression is current that such a library exists mainly to store conveniently the current books and periodicals which a busy research worker can find time to consult. Frequently it is forgotten that, without a wider interpretation of the functions of a scientific library, most of those current books and important records of research could not be written, or so well written. Most scientific books are merely condensed and coordinated summaries of activities previously recorded in periodicals; most articles in periodicals must be correlated to records of previous researches. In short, the past records must be faithfully preserved and indexed. And indeed, unless this can be done, many of the investigations recorded are unlikely to contribute to the further advance of science. Only the older general libraries and large specialist libraries possess such records of the past, and even in these it cannot be said that, in the field of science and technology, complete records exist. Nor can it be said even that the records now published are being adequately preserved. Every librarian of experience knows how rapidly a work becomes "out of print" and unobtainable, how difficult it is to discover, even references, to many, quite recent, researches and records. In fact, it is possible that a greater proportion of the records of long past researches might be reconstructed than of the accounts of current investigations.

In catering for the busy research worker then, a general library must not ignore the fundamental principle that the preservation of records of investigations throughout the world, as complete as possible, is a function that such libraries alone can perform.

Survey of the Output of Publications. Before a library can adequately perform its primary function of preserving such records as may be held to lie within its scope, it is necessary that it should be provided, or provide itself with, a complete list of publications issued. Here, at the outset, the difficulties of the librarian commence. It may be taken for granted that no such complete bibliography exists for past literature. For current literature two main sources are available. Firstly,

there are the catalogues of the great national libraries, such as the copyright libraries, which endeavour to possess a copy of every book printed in their own country. Unfortunately there is usually such a large time lag between the receipt of the books and the publication of the catalogue notices as to render these catalogues unsuitable for book selection. Moreover, the non-inclusion of many foreign books, and the fact that the titles are not classified by subject, makes these catalogues difficult to use for a purpose for which, indeed, they are not intended.

There remain the current national bibliographies of published books. These are largely the organs instituted by the major publishing agencies in different countries and cumulated into national lists. They are fairly comprehensive but by no means complete, since they ignore the output of smaller firms not subscribing to the organ, and omit also most of the publications of learned societies, and the journals produced so frequently by small independent agencies. In both cases it should be clearly recognised that none of these catalogues contains any references whatever to the contents of periodicals.

Summarising the situation, it can be said that to obtain a complete record of the titles of current books and periodicals, quite apart from the contents of both types of publication, is a considerable task.

The reference lists and reviews given in journals are inadequate for the purpose of any library; they contain merely a small proportion of published literature.

There is no doubt that some need exists to organise machinery for recording the publication of every new book, and at least the birth, if not the subsequent demise, of every new periodical, in whatever country or language such may appear.

The minimum requirement, at any rate so far as science and technology are concerned, is that some institution should compile as complete as possible an index of this current production. Moreover, it is difficult to avoid the corollary that this record should be made generally available by publication. The cost of such a service would be very small and the cost of distribution would almost certainly be recovered by subscription.

The record here contemplated is merely one of the title of

every new scientific book and new journal published each year, perhaps 15,000 items in all. Preferably each reference should be classified by subject for convenience of scrutiny. The publication should be issued in subject arrangement, with an author index, and would thus represent an indispensable reference work for librarians faced with the problem of selecting books and periodicals relating to specific subjects.

Selection of the Publications. Given an adequate survey of the current production of literature, the next problem is to select what publications shall be acquired. Here limitations of funds, scope and staff restrict the choice. In practice, a compromise is effected by concentrating on the better-known publications, the basis of selection being largely that of "repute." Publications, which are prominent in virtue of the high standing of their issuing bodies or their more efficient propaganda, tend to be acquired, not merely in those libraries, to the scope of which their contents are specially appropriate, but also in many others. Whereas, publications relatively obscure tend to be ignored. A reference to the representation, in the various libraries of Great Britain, of the known current scientific periodicals, as listed in the World List of Scientific Periodicals, reveals the extent to which overlapping in the collection of the more prominent periodicals has proceeded side by side with the neglect of a vast residue. Doubtless a considerable portion of this residue is unworthy of serious attention. On the other hand, it is certain that much excellent original research lies concealed in publications that are inaccessible in Great Britain. Probably much more would come to light, were the facilities for indexing better organized.

The present unsatisfactory state of library services is the natural outcome of the origin and development of libraries in the past. Libraries grew up in connection with centres of learning, or they were created to meet special needs. Thus we have the libraries of universities, old and new, the libraries of scientific societies, of many institutions of various kinds, and libraries of Governmental Departments: libraries of widely differing scope and of all degrees of completeness up to the great general libraries of science.

These services were suited to the restricted number of

investigators and research institutions that existed until recently. But, almost during the last generation, conditions have changed completely. Centres of research have multiplied a hundred-fold, in localities scattered everywhere throughout the world, and, with the resulting increase of research, has come also a corresponding increase in the number of publications in which it is recorded. Further, the water-tight compartments, into which scientific knowledge used to be divided, have broken down completely, and now the different branches of science and technology are inseparably intermingled.

Partly for lack of the necessary organisation for surveying the enormous output of new literature, and principally because of the scattering of literature on special subjects, no special library can be made complete within its particular purview, and the urge for completeness tends towards the transformation of special libraries into general libraries. This has been the origin of many of the large general libraries of science, *e.g.* the Surgeon General's Library of Washington and the Library of the United States Department of Agriculture. The Science Museum Library, which developed from the Library of the Geological Survey, is no exception to the rule.

This tendency on the part of all special libraries leads to excessive duplication. Thus on the average one-third of the contents of each special library is redundant, another third is duplicated in other libraries, while, within their particular field, the representation of special libraries is partial and relatively inefficient.

Furthermore, there are grave deficiencies in the accessibility of those publications that are available. Research workers, desirous of consulting books or papers related to their special inquiries, continually find that only part of these can be consulted in any one library, since a large proportion are scattered throughout works devoted to cognate subjects, which are represented only very inadequately in their special library.

Indexing the Literature. The difficulties already mentioned are aggravated still further by inadequate abstracting and indexing of the records, which make it impossible to ascertain all that has been published on any subject.

It is a recognised function of any library that it shall render its contents properly available by means of adequate cata-

logues and indexes. Properly speaking, a catalogue confines itself to specifying the author, title and subject of a publication treated as an entity. Usually such portions of the work as can be defined as parts, *e.g.* specified numerically as chapters of books, or issues of periodicals, are ignored in cataloguing. On the other hand, the make-up of publications is very diverse, the separate parts of some books are of such importance that they may be regarded as books in themselves; the separate issues of many periodicals are really monographs on definite subjects. The practice differs in different libraries in regard to the treatment of such parts. There is, however, a growing tendency to insert in the catalogue what in England are called "cross-references," and in the U.S.A. "analyticals." In this way, catalogues become to some extent "indexes," in which the units specified are individual parts of books, and outstanding papers in the transactions of learned societies and journals.

Supplementing the activities of libraries in this direction, there are the various types of reference works, reviews, abstracts and bibliographies. The total output of such indexing material in the scientific field is enormous, but inchoate and incomplete. All these bibliographies are produced from the point of view of a particular subject, and the mutual dependence and interpenetration of all branches of science makes it impracticable to select from the mass of scientific periodicals even the bulk of the literature within the fields to which these bibliographies relate.

Consequently a critical analysis of the present aggregate output of such bibliographies reveals, as might be expected, duplication of the more prominent references on the one hand, coupled with a complete lack of recognition of much of the literature. Realisation of the inefficiency of the method of indexing from the point of view of special subjects has led to various attempts to provide co-operative indexes, of which the International Catalogue of Scientific Literature was the most notable. An alternative method, the applications of which have now reached an extent even greater than that of the International Catalogue, consists in the adoption of a standard classification, so that all bibliographies using ~~the~~ system contribute to a universal index.

However, so far as this problem is concerned, the function even of a large library can hardly be extended to include the production of a complete index to its contents. It can do little more than co-ordinate its various reference works as well as possible. One method of co-ordination consists in aggregating the various bibliographies that are produced and classified uniformly according to a standard classification. Many published indexes are now classified according to the Universal Decimal Classification, and issued, either in the form of cards, or in units adapted to mounting on cards for the purpose of successive cumulation. It is open to question whether the card-index represents the ultimate solution of this problem, but it is, at present, a fairly effective medium for cumulating, in a comparatively convenient form, a series of references issued from one or more sources at different times. In this way a great library can compile an index to its contents, the material for which is prepared and published by other agencies. The references so collected fall together by subject, where they can be found immediately, thus eliminating the waste of days or weeks of search in miscellaneous unco-ordinated bibliographies.

The Supply of Information. The information which may legitimately be demanded from a scientific library by its readers and borrowers varies from a single reference to a list of papers, as complete as possible, on a special subject. The digesting and critical reviewing of the literature is hardly within the scope of any save a very specialised library.

In its efforts to provide adequate bibliographies on a specific subject, a library is at present gravely hampered, firstly by the deficiencies of existing indexes, secondly by the inadequacy of its own stock of literature, and thirdly by the inaccessibility of the literature that would supplement its own stock. All these difficulties decrease in so far as the library and its indexes become more complete.

It is evident from the above survey that library services as regards pure and applied science are gravely deficient in many vital directions. In the sequel, it will be demonstrated that the establishment of a central library of science, with practical and well defined functions, would eliminate many of these defects and go far to remedy the remainder.

The Problems and Cost of a Scheme of Co-ordinated Special Libraries of Science and Technology. As the deficiencies of libraries have been realised more and more, suggestions have been made that co-operation in the acquisition of books would meet the need. From the preceding, the impracticability of this idea is indicated. It will become clearer in the sequel. Moreover, as yet the suggestion has remained unfertile. Each library endeavours to fulfil the purpose which called it into being, and to meet the demands upon it as well as its resources will allow.

Of late a movement has developed towards co-operation by the loan of books from one library to another. And among Government libraries in Great Britain the Science Library has taken the lead in this direction.

Nevertheless, the difficulty cannot be solved economically by co-operation. This involves incalculable waste of time by scientific men in travelling from library to library in search of the scattered literature of their subjects, as well as the creation of an unproductive organisation which must be both exceedingly expensive and inefficient, as will be shown.

It will be assumed that the objective is to devise a scheme for co-ordinating the acquisition and supply of scientific and technical publications by a group of established special libraries, each of which has some broad scope such as, *e.g.* pure science, natural history, medicine, engineering, agriculture, etc. The aims are to define with reasonable rigidity the scope of each member of the group; to ensure that each member then acquires a collection, as complete as may be necessary, of the appropriate literature; to avoid undue overlapping in acquisition; to provide the clients of each library with reference facilities; and to provide facilities for consulting literature externally to the libraries.

It is assumed that to some extent duplication of acquisition is necessary, in order to provide for reasonable continuity of reference in any one library, and to allow for the lending of publications without injury to the reference facilities.

It is assumed that some controlling organisation is created, to ensure effective co-ordination. For the purpose of reference, this controlling body will be designated the "Central Control."

It is axiomatic that the basis of control will involve the

specification of publications in the usual library manner, *i.e.* the author and title and the subject.

Therefore, in addition to recognised experts in the various branches of science, the Central Control will need to be equipped with a staff of cataloguers competent to specify the publications, or to recognise specifications, in all the variety of type and language that are experienced in scientific literature.

In regard to the scope of the various libraries. It will be evident that limits cannot be too rigid. Consequently it will be necessary to define for each library a series of relatively minute subject classes, and yet to permit two or more members to acquire the publications relating to groups of these small classes. For example, it is not possible to restrict a library concerned with natural history from acquiring certain classes of the groups which are proper to the "exact sciences," *e.g.* microscopy. To specify the scopes of the different libraries adequately and to allocate the literature competently, involves fairly minute classification.

Let it be assumed for simplicity, that we are not concerned with the literature of the past, but only with the publications that are new, and with the continuations of existing periodicals and serials. In the first year of operation of the scheme, some twenty thousand new books, pamphlets, volumes of serials and periodicals will appear. Only for established serials and periodicals will it be possible to provide a comprehensive list of titles, and to conceive that these are classified and allocated in anticipation. Actually no such classified list and allocation exists at present, and its compilation—*e.g.* on the basis of the World List of Scientific Periodicals,—would be no mean task. Nevertheless, conceive that this is done. We have still to deal with the annual production of new books, pamphlets and new-born periodicals and serials. In the first place some comprehensive system of ascertaining these "births" will have to be devised. And, as has been shown, this requires considerable machinery. Since, for the purpose of co-ordination, the Central Control must keep a species of union list of these new publications, it must adequately catalogue and classify some twenty thousand items a year. Moreover, it can hardly catalogue and classify with the necessary precision, and cer-

tainly not allot the publications despotically, without seeing the material. Hence, either it will be forced to set up a new library, or, having acquired specimens of the serials and purchased copies of the books and pamphlets, it will have to distribute them to the appropriate members of the group. In the latter case, either these members have to await the allocation before they can get their copies, or get them first and subsequently obtain duplicates from the Central Control. In the former case, the Central Control becomes a reservoir library, at any rate for books and pamphlets. It may be observed that this very tendency is illustrated in the case of the National Central Library in London, which began mainly as a "clearing house" for lending the works of other libraries, and now has been provided with accommodation for a million volumes. In view of this example it may be preferred to advocate that the Central Control shall not preserve the specimens, books or pamphlets, but shall forward them as quickly as possible to the libraries deemed appropriate. In any case, it becomes obvious that the Central Control has to have an "accession and registration" staff, as well as a "locating, cataloguing and classifying" staff. But at least it would not have the books!

Now comes a further complication. The publication of one of the great "Handbooks" is commenced. It is to comprise the usual large number of volumes, parts and subdivisions, some of which are appropriate to many libraries other than the one for which the whole Handbook is appropriate. The necessity arises for minute allocations, and piecemeal acquisition on the part of the special libraries, whose librarians complain that they have to catalogue and shelve a lot of bits instead of getting the whole work. The same thing happens with series of monographs, reports and bulletins, and periodicals of wider scope. Before we know where we are, unless indeed we have had some experience, we find our accessions and cataloguing and classifying and allocation machinery growing to formidable dimensions. We have exceeded the twenty thousand a year figure and are advancing towards the fifty thousand or even a hundred thousand a year figure. In fact, the Central Control has to establish all the machinery of a really large library, except that it will have no

books. However, there will be a fine union catalogue, from which can be supplied information as to what literature is published, where a prospective searcher can see it, when he gets there, or from whom he can borrow it, if it is not wanted for reference.

Thus the Central Control begins an elaborate information service. Then it appears that, frequently, specific information is found not in a book, nor in a pamphlet, nor in a part of a series or a handbook, but in a paper in some society's transactions, or an article in some review. The information service having got so far, why not carry it a stage further? And so to the subject index of papers, and the collection of bibliographies of all kinds, notwithstanding that an information service divorced from a library must remain ineffective.

Finally, consider the supply of literature. The Central Control is now the accepted medium for ascertaining what literature exists and where it can be procured. Applications come in; catalogues and indexes are consulted by the scientifically trained staff; directions are given, and the inquirer proceeds gratefully on his way. He begins a research: finds more references, wants to see them; finds he can only see some where he is; is referred for the rest to the Central Control; more searchings, more locations, more instructions, more travel.

And the cost? An estimate of £5,000 per annum for the cost of this Central Control without the books is certainly a very modest one. A vast organisation would have been set up for doing everything that a complete general library of science and technology would have to do, and for doing many other things, such as keeping details of the holdings of other libraries, for doing all except actually possessing, storing and supplying the actual books. Yet it is the books that the public wants!

Although the machinery would cost almost as much as is needed to buy a complete set of books being "listed" and "cleared," the research worker who asks for a book is given only a series of journeys, with a list to help him to while away the time in the Underground Railway.

Throughout the above, nothing has been said as to the difficulty of exercising the necessary control over the acquisi-

tions of a group of libraries. A benevolent despot at the Central Control is assumed, and a series of enthusiastic co-operators at the head of each special library.

But in practice, things would be very different. The various special librarians would certainly be tempted to dislocate the machinery. The Central Control would be left with a painfully acquired Union Catalogue, and a fine stock of specimens. For instance, the Control would no doubt be able to tell an inquirer that the library of the Ministry of Agriculture contained such and such works on Agriculture. The latter library could tell him that of course, but he would lose the satisfaction of having found it out at a very expensive centre of information maintained by the taxpayers. It may be noted here from American and other estimates that it costs about 7s. 6d. each time to *locate* a desired book at present, with existing centralised machinery.

In all this scheme, nothing has been assumed as to the function of an existing library which includes all science and applied science in its scope. The deduction cannot be avoided that such a library is pre-eminently fitted to exercise most of the functions found to be necessary for the Central Control and has already most of the staff needed. On the other hand, the previous restriction, preventing the Central Control from having an actual stock, now vanishes. The advantages of having a comprehensive central stock are apparent. It becomes a reservoir upon which the special libraries can draw.

The final question now arises. Is it necessary to inflict on this centre the burden of controlling the other libraries? Would it not rather be a practical solution to assume that the special librarians, recognizing the existence of a really complete central stock, would of their own accord feel relieved of the necessity of acquiring much material, outside their proper scope, which they now feel bound to acquire?

The conclusion is inescapable that true economy and efficiency lies in the direction of developing the existing facilities of an existing general Science Library as a central library of science.

Besides being a general reference library of science and technology, where all existing literature on a particular subject can be consulted in one place, the Central Library is conceived as fulfilling the following additional functions :

1. Compiling card indexes, both by author and by subject, of titles of currently published scientific literature including books, monographs, serials and periodicals. From this index it would be practicable to supply lists of new publications in any desired field. The issue of such reference lists relating to wide subject groups might take place as a principle, at regular periods. Alternatively, they might be issued only in response to specific requests.
2. Compiling as complete as possible a collection of current scientific books and periodicals in all branches of science. Cataloguing this collection in the normal way and classifying the items as *specifically* as possible. The completeness of the collection should only be limited by the following considerations :
 - (a) Excluding elementary or "popular" books and periodicals.
 - (b) Excluding publications which are obviously of a trivial nature.
3. Issuing regular notices of its holdings and new accessions. Issuing from time to time cumulated catalogues.

Possibly issuing printed catalogue cards, as is done by the Library of Congress.
4. The maintenance of a complete set of bibliographical indexes, cumulated as far as possible according to subject. The ideal would be to have at least one reference, preferably with a digest or annotation, to every book, monograph, paper and article. The fulfilment of this ideal would depend mainly on outside agencies, but the Library should attempt to influence such agencies to adopt standard methods of producing bibliographical indexes.
5. The supply, in response to requests, of complete lists of references to the literature of any specified subject, in so

far as this information cannot be made available by specialist libraries.

6. The lending of books to research workers and students through the medium of approved institutions and commercial agencies. In considering the effect of lending on the use of a library for reference, it must be borne in mind that the efficiency of a library depends on the extent to which it contains the literature within its scope. If a library does not possess a book demanded by a reader, that library is less useful than another library, which by reason of its completeness does contain the book although that book may be absent for a few days. External lending must affect the ordinary function of a reference library. But provided that inquirers borrow publications from the Central Library only when local reference facilities fail, the number of books on loan will not amount to more than a few per cent. of the book stock. The extent of this temporary deficiency is not to be compared with the lacunæ now existing in libraries as described above. And the usefulness of a complete library will be very much greater than that of a less complete library which does not lend books. Experience has shown that there is a real and growing need for external loans and that only very little interference is caused with reference facilities.

The Cost of a Central Library. Experience shows that a Central Library of the type visualised above need cost little more than is at present expended on many special libraries, and much less than is expended on many large public libraries. In any case, in view of the present existence of such libraries only the small additional cost needed to complete them is in question.

The Extent and Organisation of such a Central Library.

(a) *The Survey of Literature.* The contemplated survey of the current output of scientific and technical literature would be carried out, as now in some national libraries, by amalgamating selected items from a comprehensive series of national publisher's bibliographies into a card-index. From other sources, references, to new periodicals, publications of international

congresses and other new works would be added to the index. Notices of their new publications from minor publishing bodies would be elicited, thereby making the index reasonably complete. In this way, the major part of the world's output would be indexed. Since publishing agencies have every inducement to supply notices of their new issues, there is no reason to suppose that the index could not be made almost exhaustive.

The reproduction and publication of this index would permit of copies being circulated to various libraries and institutions, when it would be relatively easy for such recipients to inform the Central Library of any omissions which they had noted in virtue of their special connection with certain fields. An occasional supplement could be provided as additional items were recorded, and all recipients would mutually benefit by the co-operative labour.

(b) *Collection of the Literature.* The total output of literature in this field represents about fourteen thousand scientific books and fifteen thousand important periodicals, which are the estimated desiderata for the contemplated central library.

(c) *Indexing of the Literature.* In this respect the experience of the Science Museum Library is relevant. This Library has already reached a stage beyond which substantial progress can be made only by inducing outside indexing institutions to co-operate in the adoption of the standard Universal Decimal Classification. The experience of the past few years shows that the prejudices, which are met, when any reform of this type is advocated, are slowly but steadily being overcome. Including contributions from agencies abroad the present position is that about 130,000 references classified by this system are being filed annually, which constitute this co-operative undertaking, the greatest bibliographical effort yet achieved.

The value of what is already in being is obvious, and the cost of the index is a mere fraction of the cost of many similar aggregations of references. For example, the pre-war cost per reference in the Science Museum Library's Subject-Matter Index was about one halfpenny including filing, whereas the cost of purchasing card references issued by such

institutions as the Library of Congress and Engineering Index was about a penny a card, *exclusive* of filing. Moreover, the references incorporated in the Science Library's Subject-Matter Index frequently comprise abstracts of the articles, whereas the Library of Congress and Engineering Index cards are purely titles and very summary digests.

(d) *The Supply of Information.* If it be permissible to quote the Science Museum Library again, it seems relevant to state that from its complete collection of scientific and technical bibliographies of all sorts, this library is already supplying lists of references on specific subjects in response to inquiries. In so doing, it meets the need of those research workers who are not in touch with any library possessing equal facilities, and at the same time supplements its Subject-Matter Index, rendering this index more complete for future use, both in the subject of inquiry and in related subjects.

This service of the Science Museum Library has increased steadily, but on the whole slowly, in recent years. It is not anticipated that any Central Library would find itself constrained to meet a demand greatly exceeding that which the Science Museum Library now experiences, since it is intended that, as now, enquiries would usually be made to the appropriate specialist institutions in the first place, and referred to the Central Library only when references to information scattered in the mass of literature of cognate subjects were needed. Any estimate of the increase can only be provisional, but there is little doubt that the imposition of small charge would keep the demand within any desired limit. From experience it appears distinctly possible that the service might be made to pay for itself by the sale at a nominal price, or the exchange of, copies of the bibliographies compiled. The present inefficiency of indexing, however, militates against the economical supply of bibliographical information. So much time has to be spent by skilled assistants in collecting the references from the various indexes, and publications dealing with the subject, that the cost of compiling bibliographies is much greater than would be necessary if a standard system were in general use. As the scheme for co-operative indexing on the basis of the Universal Decimal Classification gathers

adherents, this cost of compilation should be reduced in proportion, and the output of bibliographies could be increased without increase in the staff. Meanwhile, a survey of the widely divergent subjects on which bibliographies have been compiled by the present staff of the Science Museum Library shows that the staff is capable of dealing with inquiries in any branch of science—as indeed it must be, in order properly to classify the Library's regular accessions.

(e) *The Supply of Books, Including Loans.* In this direction also, the Science Museum Library has already had considerable experience of the call which a Central Research Library might expect. Although there is a steady increase yearly in the demand made upon the Library, the aggregate demand does not compare with the figures experienced by, e.g. the British Museum Library and many of the great Public Reference and Lending Libraries.

Advantages in the Establishment of a Central Library. A complete, instead of a partial, stock of current scientific publications would be available for consultation, and all in one place.

This would enable lists of papers on special subjects to be supplied, including not merely, as at present, articles published in journals devoted to the special subject, or to subjects closely related to it, but comprising all papers relative to the subject of enquiry whatever their source.

In addition, the entire cost of the cumbersome and unproductive machinery for central co-ordination, union cataloguing, and location of books would be avoided: the actual cost of a single loan being reduced from 7s. 6d. to 5d.

The regular issue by the central library of its classified lists of accessions should enable many special libraries to dispense with a large portion of the skilled labour now engaged in duplicating this work. They would thus be enabled to concentrate on the detailed subject cataloguing of the literature within their field.

The labour of keeping track of new books and periodicals in each special field would be left to the central library.

Many special libraries would be able to effect great economies in their purchases of publications rarely needed, relying on the central library for the loan of these.

The Effect of the Existence of a Central Library on the Functions of the Specialist Libraries.

(a) *Acquisition.* Specialist libraries would continue to govern their acquisitions according to their local needs. Economy would be attained in two ways from the existence of the central library. Firstly, from that library the special library would obtain a regularly issued, comprehensive classified list of books and periodicals published. By referring to the appropriate sections, each special library could readily ascertain what publications existed in its own proper field. Moreover, the specialist journals, which at present provide in a haphazard way reviews of literature in their field, would be induced to make these reviews more complete, and thus aid the special librarian to make careful selection from the material available. Reviewers would be able to consult the works in the central library, if review copies could not be obtained.

Secondly, the special library's need to acquire a good selection of literature in fields cognate to its own would vanish, because a far more complete collection of such literature would be available at the central library.

(b) *Cataloguing and Classification.* The resources of the central library, and its issue of standardised classified catalogue entries of its accessions would tend to save the special libraries the skilled and expensive labour of expert cataloguing and classifying, which is now expended in duplicating catalogue entries in every library. Skilled staff would then be made available for more intensive subject-indexing of the published literature within the scope of each special library. Whether such a card catalogue service as that of the Library of Congress ought to be maintained in every country is a question. But, in any case, it is practicable for special librarians to receive copies of the central library's catalogue entries, and have these cut up and mounted on standard cards for their own catalogues, thereby saving much of their costs. It was estimated, for example, that before the war a single catalogue entry cost to prepare in the Science Library about a shilling, whereas the cost of a copy need not exceed one-tenth of a penny, and this copy could then be dry-mounted on a standard card at a further cost of one-fifth of a penny.

(c) *Information and Bibliography.* Specialist libraries large and small would remain the primary sources of supply for information on subjects within their proper fields. When the search needed to be extended into the mass of literature on cognate subjects, the inquiry would be transferred to the central library.

The function of the central library would be to maintain a complete—as distinct from a partial—collection of literature, which could either be consulted by the specialist in his more exhaustive researches, or by the central library's own staff for the provision of bibliographical lists. It would not be the province of the staff of the central library, except in so far as they were particularly expert in certain fields, to extract from the references listed the precise significance of the information in respect to the special inquiry. That function would remain for the specialist and to some extent for the special librarian or the staff of experts available for his consultation.

Conclusion. From the foregoing, it is abundantly clear that the establishment in each country of such a central library of science and technology would alleviate the disabilities under which scientific and technical work is carried out at present, while the additional cost of such a library would be small compared with the advantages gained.

CHAPTER VII

SPECIAL LIBRARIES AND SPECIAL INFORMATION SERVICES

As has been remarked in the previous chapter, many kinds of library are included in the term "special." It includes, in fact, all libraries that are not general. A general library of science is, of course, a special library. The organisation of such a library has been discussed in the preceding chapter. Here, we shall confine ourselves to libraries which cater for the various branches of science, large or small. These may be libraries of scientific societies, or research institutions, of business firms, or industrial organisations. The purpose, for which such libraries are intended, may vary greatly. That they exist to collect and supply information is the one function that they possess in common. While the libraries of scientific societies often do little more than collect the books and periodicals, in which the information on a particular science is recorded, for consultation by the members of the societies, or for loan to them, the libraries of research institutions and business organisations usually develop a service for keeping their clientele informed of all developments within their respective scopes.

No efficient information service can exist, without an extensive library. Access to the literature is essential at every stage in the process of making information readily accessible. The literature is needed first for classifying and abstracting, secondly for making bibliographies and digests, and finally for consultation by the users of the bibliographies and digests.

Some information services have grown up in previously existing libraries, or in connection with them although they have mostly had the nucleus of a library to work on. Other services have found it necessary to develop their own libraries.

The Dutch Institute of Documentation was based on the Dutch Patent Office Library. The Science Library information service, on the Science Library. The former information service was developed as a separate institution in the same building as the Patent Office Library. The Science Library information service arose as one of the facilities afforded by the library. The library of the Information Bureau of the Electrical Research Association was partly developed for that Bureau.

Scope. That they should collect the literature relating to their special fields, is the first essential of all such scientific libraries. To collect all such literature, we have seen already, is impossible. It is scattered throughout the whole mass of scientific publications. And we have previously remarked upon the resulting tendency of the larger special libraries to develop into general libraries of science. Usually, however, special libraries must depend upon such general scientific libraries for the information on their respective special subjects, which is scattered through the general works and periodicals on science and engineering, and in other books and periodicals, covering fields, more or less related to their own.

Therefore, the task of special libraries is to collect all publications specifically devoted to their special subjects, and in addition, some of the more important books and journals on general science, pure and applied, and on subjects cognate to their own. To select, which of these additional books and journals to acquire, is the difficulty. Indeed, before they can obtain any literature at all, they must first find out what literature exists. This aspect of their work has been discussed in the previous chapter. A classified index to the world's published output of literature of all kinds is badly needed, both for general, as well as for special scientific libraries. For lack of this, each general and special librarian must search the cumulated publishers' lists, catalogues of Government publications and even announcements in periodicals and then make his own special selection. For this, indeed, he needs some training and experience in librarianship, as well as knowledge of his special subject.

Acquisition. The selection being made, the next thing is to

acquire the books and periodicals, keeping a record of those ordered and the booksellers to whom the orders have been sent. Possibly the simplest way to do this is to make use of books of order forms, in which only one item is ordered on each form and two extra copies are made by carbon paper: the top copies go to the booksellers and one each of the carbon copies are placed, respectively, in trays, under the names of the authors of the books, or the catalogue titles of the periodicals, and the names of the booksellers. As the publications are received, both copies of the order forms are dated and replaced behind guide cards in the same trays. This makes it possible to trace, at once, what books have been ordered, and from whom, and whether they have been received or not.

When it may be possible to acquire a publication, more usually a periodical, by exchange, or presentation, it is convenient to make use of a standard form of letter, with blanks to be filled in to meet each particular case. Then the typists are supplied with the information for the blanks, with the number of the standard letter, in case more than one is used, written on forms of the same size as the order forms, which can be filed in the same trays as the orders for other publications.

Accession registers. For single works received, the order forms act as an accession register. The title page of the book received is stamped, like the order form, with the date of receipt and the book is sent to be catalogued.

For works in progress and for periodical publications, separate accession registers are needed. These registers are usually maintained on cards, which show the name of the publication, its source, whether obtained by purchase or exchange, when the subscription was paid, the year of publication of each volume, the number of each part and the date of receipt. Each register is kept in alphabetical order. Difficulties may arise if the entries in the periodicals accession register do not correspond to those afterwards adopted for the catalogue. Librarians know that the cataloguing of periodicals needs considerable training and experience. If the clerical staff in the Accessions Department do not possess sufficient qualifications, they will sometimes enter new

periodicals under wrong headings. To remedy this difficulty, the details of each new periodical are entered on a card without the heading being filled in. This card is then sent, with the periodical, to the Cataloguer, who fills in the proper heading, or affixes a copy of the catalogue title, and returns the card to the accessions clerk.

Cataloguing. From the accessions department, all publications received go to the cataloguing department. The process of cataloguing is the most important operation of the library. For, unless the accessions are correctly catalogued, it may be quite impossible to identify them, subsequently. Even the smallest library should adopt a standard set of cataloguing rules, such as those of the British Museum, or the Anglo-American code. However sufficient in the first place a few simple rules may seem to be, sooner or later difficulties will arise, necessitating revision of the system. And having settled these, new difficulties will appear and cause further trouble. Because, each time the rules are altered, the library catalogues must be revised. To adopt a standard system at the outset, is the easiest policy.

More than one copy of the "author" catalogue title will be required. We have just seen that a duplicate is needed for the register of periodicals. Various other needs occur. By writing the decimal classification numbers on the "author" catalogue titles, the same titles will suffice for both the author and the subject catalogues. And as each book, or paper, requires on the average two classification numbers, two extra copies are required for the subject catalogue. Other uses of the catalogue title may be, for keeping a list of books in the order in which they occur on the shelves, and for maintaining a list of recent acquisitions.

To make these extra copies in one operation, it is convenient for the cataloguer to type his titles, directly, with a typewriter. By using best-quality carbon paper, as many as eight copies of each title can be prepared at a time. The foolscap paper used should be thin and fairly tough and perforated down the middle and across, to make eight exactly equal slips, with a half-inch strip at top and bottom to enable it to be held securely in the machine. The slips are subsequently dis-

severed at the perforations and collected into bundles of the same designation. For the author and subject catalogues, it is convenient to mount the slips on 5-in. \times 3-in. cards. The best process for this purpose is the shellac dry-mounting process.

It is not necessary, as a rule, to catalogue reprints. If these are classified by the Universal Decimal Classification, they can be kept in pamphlet boxes in numerical order and serve as their own subject catalogue.

Special libraries often collect and store various reports, drawings and plans, prepared by the technical staff of the organisation with which it is associated. These are usually catalogued in the ordinary routine and afterwards filed in filing cases of convenient sizes.

Allocation to the Shelves. In special libraries there is not so much objection to using detailed subject classification on the shelves. Because, the library being smaller, it is less necessary to conserve space. It does not matter so much, if space for growth is left between the minor classes, and less labour is involved in shifting all the books to make room for a section that has grown exceptionally. Also, with fewer readers, books are less likely to be replaced in wrong classes.

In smaller libraries, therefore, the decimal number, already allotted to the catalogue title, will serve to designate the location of the book on the shelves. For larger libraries shorter numbers are preferred. As a rule, the numbers are written inside the back covers of the books, where, also, the initials of the cataloguer should occur. When press marks are used instead, a catalogue title is mounted on a strip of paper, all the strips being of the same size. This strip is placed in the book. Then, the attendant, who puts the book away, marks the press mark on the strip, as well as inside the back cover of the book. The press mark is copied on to the author catalogue title, so that the book can be found when wanted, and the strips are kept in order of press marks as a shelf list for checking the stock. If desired the press marks may, also, be indicated on the spines of the books.

Literature search and the making of abstracts. The function of a special library being to collect, classify, and make available

recorded information relative to the activities of its mother organisation, the question arises, whether the search and abstracting of the literature should be done by the library staff, or by the research staff of the organisation.

It may be argued that, by doing this work themselves, the library staff saves the time of the more highly paid research staff. On the other hand, it may be considered that to do it properly needs practical research experience. It needs, also, bibliographical experience. And, when the librarian has had practical technical experience, it is more efficient that he should take charge of the abstracting. Or, in some cases, a special information officer may be employed. But it is desirable that he should have had sufficient bibliographical experience.

The abstracting done in special libraries is of the second kind referred to in Chapter V. The abstracts are made from the special points of view of the organisation concerned, as they may vary from time to time. The general abstracts made by the various large general abstracting services may suffice, sometimes, and for some requirements. Otherwise, they can only indicate where the special abstractors are most likely to find the information sought. For this purpose, these general abstracts are essential because they cover a so much wider field, and point out sources of information, that could not be found by a special abstractor, searching only about a hundred journals.

Consequently, files of the regular abstracting journals, covering the broad fields, of which the special subject is only one small part, are indispensable for every special abstracting service. They should be kept intact, so as to be easily consulted, in every inquiry, to supplement the information specially located in the library. And each part, as it arrives, is studied by the information officer, to make notes of articles of possible interest. Such abstracts, as bear on the special field of the organisation, are copied out and classified for inclusion in the special abstract bulletin.

Current information will be sought, in the first place, from the selected periodicals taken in by the library. Frequently these are circulated to the technical staff. Two main procedures are in vogue. In one process, the librarian reads the

parts of the periodicals as received, and writes the page numbers of the articles of special interest to each officer on the staff against his name on a printed circulation sheet attached to the part received. This list bears the names of the regular recipients of the periodicals, in the order in which, more usually, they receive them, and has a space at the end, for the addition of extra names. The current parts of the periodicals may be kept, for advance inspection, on a periodical display stand in the library. This period may be as long as seven days. During this time, an officer, who has seen all that he requires in a part, may cross out his name on the circulation list.

When the circulation commences, the name of the periodical, with its volume and part number, or its year and month, or day, are entered in a book of 5-in. \times 3-in., or 6-in. \times 4-in., forms, together with the name of the officer, to whom the part is to be sent, and the date of return. By means of the useful, labour-saving, carbon paper, these forms are made out in duplicate and filed, one under the name of the periodical, and the other according to the name of the recipient. The tray of forms, under recipients' names, contains a number of guide cards, indicating when the parts are due for return to the library. The names under each guide card come up for action when the time for collection of the parts arrives: each guide card commencing a fresh alphabet. The date for return is also stamped on the circulation list, against the name of each recipient. The issues are then circulated by a messenger, who collects, also, all parts due for return. Parts returned then have new issue forms made out, until the round has been completed. By giving each officer a number, this can be used instead of his name and the same form serves for the whole round; the entry of a new number and date showing that the part has been received back from the previous recipient.

Before the round, the librarian marks, against the articles, those he intends to abstract. Further suggestions may be made by the technical staff. After the circulation, the abstracts are prepared and the issue is put away in its proper place in the library. Alternatively, the abstract may be made before the circulation.

In accordance with the second practice, the abstracts are made by the technical staff, either when they first see each

particular issue, or when it comes back to them in response to a special request.

Abstract bulletin. Having been prepared, the abstracts are arranged in classified order, preferably by the Universal Decimal Classification, and mimeographed, or printed, for distribution. As explained in Chapter V, the use of the Universal Decimal Classification greatly facilitates the preparation of the necessary subject indexes.

Information Service. Together with its collection of general abstracts, and its own abstract bulletin, the library will possess as efficient an information service as can be developed in a special library. To make the references collected, as readily available as possible, it is convenient to cut up and mount all references using the Universal Decimal Classification and arrange them in one series, with the abstracts prepared by the library. Suppose, for example, the special library belongs to a photographic business, it is possible to make a really good photographic index by mounting *Photographic Abstracts* and intercalating them with those made in the library. A list of periodicals that use the Universal Decimal Classification and of the names of other users, is published by the British Society for International Bibliography. By adopting the Universal Decimal Classification, a library abstract bulletin is made available for similar use by other organisations. When the main abstracting periodicals are not classified in this way, they must be kept intact and used with their own indexes.

Whenever the library staff is unable to find references to information on any particular topic, or when the librarian is of the opinion that more information may exist, an approach may be made, through Aslib, which is the name of the new amalgamation of the Association of Special Libraries and the British Society for International Bibliography, to the Dutch Institute of Documentation, Willem Witsenplein 6, The Hague, Netherlands. This Institute employs a considerable highly qualified staff, for the special purpose of searching all the literature of a subject and preparing bibliographies, or digests, of information on any scientific, or technical, matter. Only the actual cost of search and compilation is charged. The service is quick. And they have rarely been known to fail.

Loan of Books. It is usual to make all the ordinary books, pamphlets and periodicals in the library available for loan to the staff, and occasionally, as a matter of courtesy, to outside bodies. The only exceptions, usually, are documents not easily replaced. The procedure often adopted, of entering the name of the work and that of the borrower in a book, is very cumbersome. As books are returned, the entries are crossed out in the register, which soon becomes a complete muddle of erasures and entries, and has to be recopied. It is difficult to find out whether a particular book is on loan, and who has borrowed it, or what works anyone has borrowed.

The best method is extremely simple. Each borrower is made to record his own loan. Books of requisition forms are provided, in which the borrower enters his own name and the particulars of the book borrowed, using a separate form for each work. By means of the labour-saving carbon paper, again, three copies are made of each requisition. The work of the library staff is confined to placing one copy in the position from which the book has been taken (this ensures that the book is rightly replaced), another copy in a tray under the name of the author of the book, and the third copy in another tray under the name of the borrower. Date-bearing guide cards may be inserted in the borrower's tray, to indicate when the books are due for return. In this way we have a signal that a book is out and to whom it is lent, a record of all books on loan and all books borrowed by each borrower. When the system is first introduced, borrowers may make some slight objection. This soon wears off, when the efficiency of the system is realised. And the saving of time to the borrower and the library staff is great.

FIFTY YEARS OF DOCUMENTATION

In previous chapters we have considered the purpose and the use of the Universal Decimal Classification. Let us now consider, more in detail, how it arose.

The Founders. Both of the two founders of the International Institute of Bibliography (*afterwards* International Federation for Documentation), Messieurs Henri La Fontaine and Paul Otlet, to whom we owe so much, are now no more. Their great achievement is that they created a complete idea and guided it to substantial success. The whole work of the International Federation for Documentation, with all its National Sections, the millions of bibliographical references that have been classified by the Universal Decimal Classification and that standard Code itself, have sprung from this complete idea. Our debt to these great men is great indeed.

The Task. What our two founders realised was, that *technical material*, as well as scientific, needed, not merely to be catalogued and abstracted but, also, *classified* by subject, so that the information on a special topic could be found at need. These facts, so obvious to us now, had come about through growth of industrial development. All such development depends upon inventors, among whom there are two most important groups: (1) professional inventors, often quite illogical, although intuitive and able to combine ideas in a surprising way, and (2) trained scientific workers. Both groups, alone, are little use for progress of technology. Professional inventors have often insufficient means to realise their own inventions, while scientific workers used to lack sufficient contact with technology to appreciate the possibilities involved in their ideas. The development of Research Laboratories by

big concerns has made it possible to combine these groups with the most modern and expensive apparatus, backed by assistance from experienced technical collaborators. The first of these Research Laboratories was, probably, that set up by the General Electric Company at Schenectady in 1901. Now their number has increased to thousands, where, perhaps, a hundred thousand qualified investigators, originate, and publish inventions and discoveries. Government employment of this principle resulted in the release of atomic energy. The process will continue and, because all scientific progress depends upon recorded facts, subject-indexes to the growing records are more needed than before.

In proof of this great need, let me recall a startling calculation made by the late President of the International Federation, Dr. Alingh Prins of the Dutch Patent Office. This calculation shows, without a doubt, that hardly ever in technology inventors know all that has been recorded on their subject. Before the four years' war, some 65 per cent. of German applications for new patents were refused, because they were not new. And, of the 35 per cent. remaining, 31 per cent. had to be limited, because the inventions were already partly known. This means that 96 per cent. of those, who think they have a new invention, do not know the facts about it. And all these repeat, to no good purpose, with much trouble, time and expense, work that is already done. Could we have a more convincing proof of the great need for comprehensive scientific subject-indexes?

The Foundation of the Institute. Most of these facts were quite unknown to Messieurs Otlet and La Fontaine. Their intuition saw the problem and the key to its solution. It was in 1892 that Otlet met La Fontaine, who was engaged in gathering documentary material upon the Social Sciences. The two immediately joined forces and created, at Paul Otlet's house in the rue de Florence, Brussels, the Office international de Bibliographie. Here they at once commenced to collect a comprehensive card subject-index. The sequence of ideas was almost inevitable. To realise a universal index, international co-operation was essential. The first International Conference on Bibliography was called for 1895. This led

to the discovery of the important fact, that, to co-ordinate the work of many bibliographers, so that it could be fitted in one index, a standard classification system was imperative. The problem thus arose of choosing a sufficient system, which must be simple and yet completely comprehensive. The Dewey Decimal Classification seemed the only possibility. But no copy could be seen or bought in Europe. And one had to be obtained from the United States. This copy was received six weeks before the Conference met. And, in this short time, Paul Otlet and La Fontaine classified the whole four hundred thousand references they had, meanwhile, collected. If we remember that to classify 25,000 references a year is good, what shall we say of completing eight times as many, each, in about one-eighth of the time? And yet the cards were ready for the critical examination of the delegates, who decided, then and there, to create an International Institute of Bibliography and to adopt the Dewey System, for extension for the purpose of a comprehensive subject-index to the world's recorded information.

At first, the institution had the double aim of realising, *by co-operation*, a complete collected bibliography of intellectual literature and of supplying, to inquirers, integrated lists of references to the literature of any special subjects whatsoever. But, as the preparation of a comprehensive bibliography on a special topic, often necessitated reference to its literature, and, as inquirers needed to consult the volumes to which the bibliographies directed them, the dual aim was naturally expanded to include a third: the founding of a central universal library. So was the complete idea evolved.

A utopian ideal some called it, and, perhaps, it was. But, it contained a kernel of practical necessity, which needed only weathering to release. Nor was this process wanting. The idea itself was new. There was no school of bibliographical opinion to support it. The need for a comprehensive index was not yet widely realised. So, from the time of its foundation, the founders of the Institute discovered that "misfortunes travel in a train." Almost every possible mischance befell them: loss of funds, expulsion from their premises, destruction of their archives, widespread ridicule and spurious imitation with the highest backing. Only their unshakable

conviction, indomitable courage and steadfast determination, enabled Messieurs Otlet and La Fontaine to outlive the storm and remain, at last, the masters of a strengthened structure. We see, now, that the first complete conception was altogether too vast. It was, in fact, utopian; beyond the comprehension of the public, who had not, yet, begun to understand the pressing need for any kind of comprehensive subject-indexes. Nor, was it practicable, then, to collect, within a single library, the colossal output of the printing presses of the world. Support for such a tremendous project was not forthcoming, and thus the work has, usefully, been limited to the field of Science and Technology, in which there has arisen definite and logical demand.

Decentralisation. Meanwhile, a further defect was revealed within the structure of the Institute. At first, the bibliographies, supplied in answer to inquiry, were prepared by voluntary collaboration of a group of scientific specialists, who had gravitated to the centre and gladly gave their services in aid. The four years' war dispersed this help and, subsequently, bibliographies prepared were quite insufficient. The reasons for this were (1) that, initially, too few of published current bibliographies were decimalised; and (2) that the Institute's non-technical assistants were unable to sort out the special references from the existing mass of unco-ordinated bibliographies. And, so, experience showed the necessity for decentralisation and for the employment of scientifically expert bibliographers.

In the light of this experience, scientific information centres were established in, or in connection with, a number of large scientific libraries, in conjunction with the literature. These services employed trained personnel and collaborated with existing information services, serving smaller subjects.

The first of these new centres to be formed was the Dutch Institute of Documentation, founded, in connection with the Dutch Patent Office, in 1922 by the representatives of certain scientific and technical societies, Government institutions and special libraries, under the secretaryship of Heer Donker-Duyvis. Just before the six years' war, it had a staff including five engineers and about eight other trained men working part-time.

The Science Library at South Kensington had always done its best to furnish information asked for, but, perhaps, its recognition, as an information centre, may be said to date from 1926, when it became possessed of a half-million references that had been decimally classified by the French National Section of the Institute, and decided to cut up and intercalate with them, all bibliographies adopting the same system, of which the Library had almost a complete collection.

In the previous year the author had succeeded to the Chief Librarianship and, with the support of Sir Henry Lyons, director of the Museum, was endeavouring to enlarge the library as a model instrument of bibliographical research : to ascertain what literature was published, collect it in the library, make it available for reading, or for loan, and to supply, in answer to inquiry, the most extensive lists of references to articles and publications on any special subject ; or, in other words, to make recorded scientific information immediately available.

In justice to the British Society for International Bibliography, which was founded as the British National Section of the Institute in 1927, it should be recorded that that big task would, certainly, have been beyond his powers, without the invaluable support afforded by the Society and its influential members, such as Prof. A. F. C. Pollard, Sir Charles Sherrington, Dr. Priestley, Sir Frederic Nathan, William Macnab and others.

The value of the Library and its information service gained appreciation. Its card index grew, until it now contains about three million cards. This was supplemented by a very large collection of all kinds of unclassified bibliographical material, which was searched by experts in answering inquiries. Yet, another defect now appeared. Because sufficient staff could not be made available, the information service was too slow. A supplementary staff was added with the aid of voluntary subscription. Then, the fact that the Library information service was not charged for, was considered to prevent the charging of a fee for the additional services. In consequence these services could not maintain themselves, and had to be suspended. As it happened, many of the voluntary subscribers were incorporated in the British Society, much to its benefit.

The Swiss Committee for Documentation, including several

information centres, was created in 1929. In 1932 a centre was established at the Library of the Berlin Technische Hochschule, while other smaller services were developed in some other countries. In every country, except perhaps in England, these documentary services have been accorded Government recognition and received support from industry, which has made great use of the facilities provided.

The National Sections. In conformity with the idea of decentralisation, National Sections of the Institute were also formed. The first of these to be founded was the Section Française, formed in June, 1896, with Monsieur C. M. Gariel, General Secretary of the French Association for the advancement of science, as President, and Monsieur Marcel Baudoin as Secretary. Even at that date, the latter had already classified two million cards by Dewey's system, and he is still a member of the Council of the Institute.

Unfortunately, the formation of like National Sections of the Institute in other countries was prevented, almost certainly, by the creation of the National Committees of the International Catalogue of Scientific Literature in every European country, as I shall shortly mention. And it was only when that Catalogue had come to grief and the four years' war had ended, that the Institute was able to extend its organisation, by the foundation of effective National Sections in the more important countries.

Until that time, the membership of the International Institute of Bibliography, except for the French Section, was restricted to its numerous individual members, with a few large specialised organisations, such as the Concilium Bibliographicum and the Fédération Dentaire Internationale. The former of these two was founded in 1890 and prepared and published a zoological card bibliography, deservedly regarded as the finest existing subject-index, until, quite recently, the Rockefeller Trust, unfortunately, transferred its grant to a non-decimalised American publication.

After the four years' war, new National Sections of the Institute were created and, at the outbreak of the six years' war, their number had increased to twelve. These were in America, Belgium, Czechoslovakia, Denmark, France, Great

Britain, Germany, Holland, Italy, Poland, Russia and Switzerland, while six others were in course of formation in Austria, Hungary, Norway, Roumania, Spain and Sweden.

The British Society for International Bibliography was founded in 1927 as the British National Section of the Institute. A prime object of the Society is to study all the facts concerning the production of documents and the publication of subject-indexes to, and abstracts of, the information recorded therein : to deduce from these facts the most efficient and economic method of organising a comprehensive subject-index with the corresponding abstracts : and to organise the production of such a comprehensive means of locating all recorded information on each topic, large or small.

It follows, from the facts deduced, that the needed reformation is to establish the co-operation of existing, self-supporting, abstracting agencies, through the adoption of a standard classifying system, together with a means of covering all the useful articles between them.

Much progress in the first stage of the programme has been made. In 1927 the Universal Decimal Classification was practically unknown in England. Thanks to the activities of the Society, by 1935 there were eighteen abstracting periodicals using the classification in the country. Besides thirteen publications classifying their articles by the system and twenty-one institutions employing the classification for internal purposes. These numbers have continued to increase, and now some hundreds of potential users are clamouring for the English edition, now being produced by the British Standards Institution, and more decimal classification entries, than published abstracts to different articles, are produced in abstracting periodicals and business files. It can confidently be expected that it will not be very long before each abstracted article will receive its proper classification numbers.

The second stage, the collaboration of existing abstracting agencies in covering all the literature, has been initiated, and we may look forward to the time when every useful scientific article will be abstracted or, at least, indexed by subject, in the appropriate abstracting periodical.

The achievement of these aims needs education of the public,

which still does not realize the facts. For this purpose, this Society holds meetings, to which its members bring their friends, contribute papers and discuss the multifarious problems of documentation, including the organisation of special libraries and information services. These papers and discussions are published subsequently in the *Proceedings* of the Society, now in its eighth volume. The Society plays its part in developing the Universal Decimal Classification, to keep pace with growing knowledge ; promotes co-operation between existing information services and assists its members in the organisation of their libraries and the use of the Universal Decimal Classification.

The International Commission of the Universal Decimal Classification. Besides these National Sections and federated international bodies, the Institute maintains the International Commission of the Universal Decimal Classification, whose able and indefatigable Honorary Secretary is Heer Donker-Duyvis. This has Subject-Secretariats for developing the main sections of the Schedules and an Executive Committee for supplying, quickly, necessary small extensions.

It is not necessary to dwell upon the many valuable publications that have been issued by the Institute from time to time. They include the *Index de l'ingenieur et revue de la presse technique* (afterwards *Meddelingen van het Nederlandsche Instituut vor Documentatie en Registratuur*) commenced in 1903, perhaps the most extensive current engineering bibliography.

The *Bulletin* commenced in 1895 and came to an end with the third fascicle of the seventeenth volume in 1914. It was continued in 1930 under the title *Documentatio Universalis* until 1932. In 1934 it was replaced by the *I.I.D. Communicationes*, which became in 1947 the *Revue de la Documentation*.

Scope. All this time, the scope of the Institute has gradually and necessarily extended to include all aspects of the art of making information useful, as in the following schedule :

The organisation and standardisation of documentation.

- (a) The organisation of documentation. Pedagogy and distribution of knowledge on documentation. (Preparation of international conferences. Meetings of National Sections to read and discuss papers by experts. Pub-

lication of the official journals of the F.I.D., "Communications" and of the National Sections, *e.g.* "Proceedings" of the B.S.I.B. Training of special librarians and information officers.)

- (b) The standardisation of subject-indexing. (The organisation of the Universal Decimal Classification and the supply of extensions to keep it up to date.)
- (c) The standardisation of the form of bibliographical references. The size and make-up of cards and entries.
- (d) The standardisation of the alphabetical arrangement of references.
- (e) The organisation of scientific publication. (Standardisation of the sizes and make-up of books and periodicals. Their indexes and abridged titles. Standardisation of sizes of reproduction materials. Lists of periodicals arranged by subject. International directory of documentation centres. Collaboration of publishing institutions.)
- (f) Terminology.
- (g) The organisation and practice of the supply of information. (Bibliographical references to literature. Abstracts. Organisation to cover all the literature. Digests. Individual information services. Networks. Central bureaux of information. Exchange of information. Tariffs. Organisation of the preparation of annual summaries of progress in different fields by recognised institutions.)
- (h) The actual supply of information and photographic reproductions (including microcopies) by the F.I.D. and its national sections in co-operation with other services.

Adversity. A feature of the buffetings of fate must now be related, which might be properly described as the unkindest cut of all. We mean attempts, by insufficiently informed societies, or individuals, to duplicate the organisation of the Institute. All of these attempts, so far, have been, eventually, abortive. But they have diverted, or absorbed, much energy that, otherwise, had been available for progress.

The first and, possibly, the worst of these calamities befell in 1901, with the appearance of a bibliography, restricted to

pure science only, with the title *International Catalogue of Scientific Literature*. This was the result of an International Conference, held in London, under the auspices of the Royal Society, in 1896. The feelings of our Founders can be well imagined, when they protested that, as the project could not be put into operation for some years, the Conference was not forced to conclude immediately, without discussion, that all systems of classification were unsatisfactory, decide to duplicate the work of existing experienced bibliographical concerns and to sacrifice to the problematical advantages of centralisation, the results of a more federative organisation, conserving the autonomy of its adult members. The Dewey System was established in America. Already many well-known European Journals had adopted it. Could they be expected to take up another system, for no reason? The proposed new classification was not better. And, in any case, it was not a question of the best theoretical classification but, merely, of a standard means of arranging references, to make possible collaboration of so many bibliographers and bring their work together into a single index.

Despite these protests, the new catalogue appeared and ran for fourteen years. In the light of experience, we see, now, that the organisation was, in fact, defective in three respects. Its organisers had not appreciated the main principles of bibliographical classification. They did not realise the disadvantage of division of recorded scientific work by countries, rather than by subjects. Nor did they realise that scientific workers needed abstracts and would not support a list of subject-references without. In fact, the undertaking was foredoomed to failure. With lapse of time, the inefficiency of the inflexible notation adopted for the classification was exposed. And, when communication between different countries was dis severed by the war, the catalogues of the pure scientific literature of separate countries could not, alone, obtain sufficient circulation, and were unable to compete with abstracting periodicals covering whole fields of science. And, so, the fabric fell to pieces, with a great financial loss. While the independent abstracting periodicals continued functioning, and the total information indexed annually, by the periodicals, that used the Decimal notation, eventually exceeded that

included in the Catalogue at best. The experiment, although expensive, proved the great superiority of the methods of the Institute.

With the failure of the Catalogue, our Institution first obtained free scope. It held more frequent International Congresses, working up to one a year. The education of the scientific public, in the necessity of comprehensive indexes and the waste of labour, time and money, occasioned by their absence, gradually proceeded. More and more abstracting agencies took up the standard code and collaborated in extending it, in step with growing knowledge, until a total of some 130,000 decimally classified references were published every year.

And, then, in 1937, a new rival scheme appeared. Monsieur Jean Gérard, one of France's eminent industrial chemists, induced the Paris Institute of Intellectual Co-operation to hold a "World Congress of Universal Documentation" for the purpose of creating a new International Institute of Bibliography, with its seat at Paris. As on the previous occasion, no valid reason was vouchsafed for the rejection of the Decimal Classification, now well up-to-date, or of the existing International Institute. Powerful support was gathered from authorities, in every other field than bibliography. And there is no doubt the project would have been achieved, had not the International Institute, meanwhile, grown up.

In the event, the National Sections of the Institute, without exception, joined in the battle. The then President of the B.S.I.B., Prof. Pollard, was unable to attend the Congress. But he sent a letter to the Secretary of the Institute of Intellectual Co-operation, stressing that the methods of the International Institute, and the B.S.I.B., were sufficient to provide a complete index to the literature of Science and Technology. Thus, the author had the honour to direct the British delegation, which included Prof. Andrade from the Royal Society and Prof. Hutton, founder of the Association of Special Libraries.

The Congress was most thoroughly arranged. At every meeting, resolutions were proposed in favour of the plan. At first the members of the Institute were, every time, outvoted. But, gradually, knowledge, experience and logic made their mark. And, after a most strenuous week, the Congress ended

with the unanimous vote of more than thirty countries for the recognition of our International Institute. In consequence of the recommendation of the Congress, the Institute became the "International Federation for Documentation," to fully indicate its federative nature. And, so, adversity again proved faithful counsellor.

From then onwards the Federation held its Annual International Conferences of Documentation, continuing to educate the public, extend its membership and National Sections, and the number of the users of the Decimal Classification. So that the almost total interruption of communications, by the six years' war, could not destroy its life. Its National Sections carried on, and, with cessation of hostilities, the Federation automatically resumed control. Yet, while the Federation was inhibited by the six years' war, this time two small black clouds appeared on the horizon. Two fresh proposals were put forth, on previous lines, for founding rival international documentary institutions. And so the periodical precipitation of disproved ideas continues. In the constitution of the Federation, there is room for every useful bibliographical undertaking. May we not hope that these new incipient precipitations will dissolve in the warm sunshine of fifty years' experience and all will join in working for the progress of documentation.

To conclude. The lesson of these last fifty years of progress is, that collaboration of existing, experienced, self-supporting, bibliographical institutions is sufficient to provide the needed universal subject-index to the useful records of discovery and invention. The Universal Decimal Classification is now widely recognised as the means of this collaboration and has become a British Standard. New applications of the Code continually accrue. The number of the decimally classified entries published, or intercalated in private files, has increased, until it should be comparable with the number of the different articles abstracted. Although each article should have, perhaps, an average of two subject entries, while the total output of such useful articles is still more than twice the number of those abstracted. The removal of this deficiency is the most important of our remaining tasks.

CHAPTER IX

THE DOCUMENTARY CHAOS

IN the previous chapter we have seen that much progress has been made in the co-ordination of documentation. But the leaven of the principles, promulgated by the International Federation, has not yet penetrated into more than half the lump of documentary material. The condition of this unleavened lump is described in the title of this chapter. Documentalists have need to realise the position, before they can consent to join in improving it. The facts have been ascertained. These facts lead to a simple plan for bringing order out of disorder. This plan, which is described in the next chapter, has been adopted by the International Federation for Documentation. But, before the plan can be applied, documentalists have to be convinced that the facts are real and that the simple plan is workable. That is the object of this chapter.

It is important to realize at the outset, as we have seen already, that the making of abstracts of scientific* papers can be achieved only in two stages. In the first stage we endeavour to produce a digest of the main subjects treated in a paper, leaving the very special points of view, the individual compounds dealt with, or the details of the apparatus described, to be treated in the second stage, by the specialists themselves, or by special abstractors, or information officers, working for individual concerns. These special abstractors do not have to deal with all these special points of view, but with only those of particular interest to the organisation that employs them. To serve all these special abstractors, a general abstract would need to include all these special points of view, which would be

* In this and the next chapter, the term scientific is intended to include technical.

impracticable. On an average, a general abstract requires two classification numbers to specify the main subjects of the paper. If there are three-quarters of a million papers to be dealt with, a complete general survey would need a million and a half classification numbers. A special abstract, which included every substance mentioned and every piece of apparatus described, might well need as many as twelve classification numbers. If twelve numbers were required, a complete special survey would need nine million classification numbers annually. As many of these numbers might never be consulted, the task would hardly be worth while. We are obliged in the first stage to be content with only a general survey which will indicate to the special abstractor the papers where he is most likely to discover the information of special interest to himself. General abstracts cannot relieve information officers of the task, which is peculiarly their own. In this chapter, therefore, we confine our attention to general abstracting.

Statistical Investigation. For complete realisation of the present bibliographical chaos, the facts must be considered in detail. Investigators know that, from time to time, researches are pursued in ignorance of recorded facts. They know also that abstracting periodicals do not always abstract important papers on the subjects of their investigations. What they do not know is the extent of these deficiencies. If we would essay the removal of these defects we must deduce the facts concerning the recording of researches and the subject-indexing, or abstracting, of the records.

Collection of data. The actual facts concerning the recording and abstracting of discoveries and inventions were deduced in detail by the British Society for International Bibliography under my direction. As the material necessary for such investigations could be found only in large scientific libraries, the statistical analyses were made, mainly in the Science Library, by a competent mathematician, the author's late colleague, Mr. E. Lancaster-Jones. The library receives about 200 parts of scientific and technical periodicals a day and takes most of the abstracting journals as well as all the most important separate bibliographies.

By the daily examination of the parts received, it was established that about three-quarters of a million useful scientific papers are recorded every year in 15,000* useful scientific periodicals, and all the 300 abstracting and indexing periodicals together publish three-quarters of a million abstracts or references. But examination of these abstracts showed that they related to only about two hundred and eighty thousand different papers, each paper being abstracted on an average about 2.7 times. This means that *less than half the useful scientific papers published are abstracted in the abstracting periodicals* and more than half the useful discoveries and inventions are recorded, only to lie useless and unnoticed on the library shelves.

Examination of the literature of a particular subject. This most disturbing fact demanded exhaustive confirmation. Only the most extensive of the checks we made need be recorded here. The total number of current periodical publications, devoted specifically to electrical engineering, is rather more than 400, of which more than 200 are of the highest or good class and will be called the "useful" periodicals. The residue is largely semi-technical or economic.

Of the 200 useful journals, 150 are received in the Science Library. All these were critically examined, as received, and were estimated to produce 9,500 useful articles a year.

Consequently, 12,000 useful articles may be taken as the annual output of the 200 useful periodicals. Similarly, the remaining 200 poor class periodicals were proved to contain annually about 13,000 papers of less value. Some of these articles might, doubtless, be of use, but, for this analysis, they were ignored.

Periodicals not specifically devoted to electro-technology, as those on physics, transport, power and many other subjects, yield at least half as many articles, at a most conservative evaluation. While general periodicals, books, monographs, pamphlets, patent specifications, standards and government reports must yield as many more such useful documents relating to the subject. Thus, in all, we find a yearly *minimum*

* The remaining 20,000 scientific periodicals contain mostly matter of less importance.

output of at least 24,000 useful articles and documents relating to electro-technology.

In 1936 references to these documents were provided by eleven abstracting and subject-indexing periodicals, devoted to electro-technology, producing a total of 27,000 references a year.

While ten general abstracting and indexing periodicals devoted to pure science and engineering, produced another 18,000 references a year in all. The aggregate of references to papers on the subject by these 21 abstracting periodicals was 45,000.

Further, it was found that only 40 of the 200 useful periodicals, and these the least important, were not indexed by any of the 21 sources but no single abstracting or indexing periodical included more than 5,000 references a year.

The 160 periodicals abstracted corresponded to about 10,000 *different* articles. Normally, articles in periodicals not closely related to the broad subject, as well as books, pamphlets and patent specifications, were hardly noticed by these sources.

A rough determination of the duplication factor, for these references, gave a maximum average figure of 3.9. This figure is considerably higher than the general average of 2.7, and is due to the fact that electro-technology receives so much attention. Similarly, the proportion of the references produced, namely 45,000, is high. But even this large number corresponds to only 45,000 divided by 3.9 or 11,500 different papers; less than half the annual output of the useful articles. And no one source of references contains more than $5/24$, or 21 per cent., of the aggregate of references to different articles. So that all the 21 sources must be consulted, in their different arrangements, to gather references to less than half the useful records.

A number of similar analyses gave comparable results and thus established that no more than half the useful records of investigation are noticed by the abstracting and subject-indexing periodicals.

These tests suggested also the real reasons for this imperfection. Individual abstracting agencies concentrate upon the periodicals devoted to their special subjects with a few of those, the fields of which are closely allied to these subjects. For

articles within their scope in "other" periodicals, these agencies rely upon the agencies concerned to abstract the subject, to which the "other" periodicals more specially relate. This practice does not suffice to pick up the majority of articles on the special subject, published in the "other" periodicals, for the simple reason that these articles are not within the scope of the abstracting agencies, dealing with the other periodicals and are not always abstracted by these agencies.

Another cause of the imperfection is that abstracting agencies generally ignore books, pamphlets, patent specifications and such-like.

The scattering of articles on a given subject. It is, therefore, necessary to examine the extent to which articles on a given subject actually occur in periodicals devoted to quite other subjects: as, for instance, a paper on the mechanism of the heart, contributed to the *Proceedings of the Physical Society*, or one on genetics, occurring in an agricultural magazine. Investigation shows that this distribution follows a certain law, which can be deduced both theoretically from the principle of the unity of science and practically from examination of the references.

According to this principle every scientific subject is related, more or less remotely, to every other scientific subject.

It follows that, from time to time, a periodical devoted to a special subject may contain an article of interest from the point of view of any other subject. In other words, the articles of interest to a specialist must occur not only in the periodicals specialising on his subject, but also, from time to time, in other periodicals, which grow in number as the relation of their fields to that of his subject lessens and the number of the articles on his subject in each periodical diminishes.

There are always a number of periodicals covering subjects somewhat closely related to any individual subject, and a greater number of periodicals on subjects more remotely related to the given subject. The nucleus of periodicals devoted to the given subject, or to the smallest larger subject containing it, must contain, individually, more articles on that subject than periodicals dealing with related subjects. In

consequence, it is possible to arrange periodicals in zones of decreasing productivity, in regard to papers on a given subject, and the numbers of periodicals in each zone will increase as their productivity decreases.

Let m be the total number of articles on the subject contained in the periodicals in the nucleus. Let $p, p_1, p_2 \dots$ be the numbers of periodicals in the nucleus and succeeding zones respectively, while $r, r_1, r_2 \dots$ are the average numbers of articles per periodical in the different zones where

$$r = \frac{m}{p}, r_1 = \frac{m_1}{p_1}, \text{ etc.}$$

Thus we have

$$p < p_1 < p_2 < \dots$$

and conversely,

$$r > r_1 > r_2 > \dots$$

Let us choose the zones so that

$$pr = p_1 r_1 = p_2 r_2 \dots = m.$$

Consequently

$$\frac{p_1}{p} = \frac{r}{r_1} = n_1, \text{ say}$$

$$\frac{p_2}{p_1} = \frac{r_1}{r_2} = n_2, \text{ say,}$$

where n_1 and n_2 are constants greater than unity. So that

$$\begin{aligned} p_1 &= n_1 p \\ p_2 &= n_2 p_1 \\ &= n_1 n_2 p. \end{aligned}$$

Now we know no reason why n_1 and n_2 should differ, and the simplest supposition we can make is that they are equal. Consequently, in the simplest possible case, we get

$$p : p_1 : p_2 : \dots : n : n^2,$$

which corresponds exactly to the expression derived, independently, from the actual facts, as we shall see.

The whole range of periodicals thus acts as a family of successive generations of diminishing kinship, each generation being greater in number than the preceding, and each

constituent of a generation producing inversely according to its degree of remoteness.

The actual investigation covered, in the first place, the references quoted in the course of four and two and a half years respectively, by the current bibliographies of applied geophysics and lubrication, which are prepared in the library. These bibliographies were selected as containing many more than the usual proportion of references on such subjects: all the large collection in the Science Library of abstracting periodicals being consulted, as well as cumulated references classified by the Universal Decimal Classification and a large selection of the "other" periodicals being scrutinised as they came in each day.

The source of each reference being given, it was possible to arrange the producing periodicals in order of their bibliographical productivity, the results are set down in columns A and B of tables 1 and 2 as follows:

TABLE 1. APPLIED GEOPHYSICS, 1928-1931 INCLUSIVE

A	B	C	D	E
1	93	1	93	0.000
1	86	2	179	0.301
1	56	3	235	0.477
1	48	4	283	0.602
1	46	5	329	0.699
1	35	6	364	0.778
1	28	7	392	0.845
1	20	8	412	0.903
1	17	9	429	0.954
4	16	13	493	1.114
1	15	14	508	1.146
5	14	19	578	1.279
1	12	20	590	1.301
2	11	22	612	1.342
5	10	27	662	1.431
3	9	30	689	1.477
8	8	38	753	1.580
7	7	45	802	1.653
11	6	56	868	1.748
12	5	68	928	1.833
17	4	85	996	1.929
23	3	108	1,065	2.033
49	2	157	1,163	2.196
169	1	326	1,332	2.513

TABLE 2. LUBRICATION, 1931-JUNE 1933 (FEW 1933 REFERENCES)

A	B	C	D	E
1	22	1	22	0.000
1	18	2	40	0.301
1	15	3	55	0.477
2	13	5	81	0.699
2	10	7	101	0.845
1	9	8	110	0.903
3	8	11	134	1.041
3	7	14	155	1.146
1	6	15	161	1.176
7	5	22	196	1.342
2	4	24	204	1.380
13	3	37	243	1.568
25	2	62	294	1.792
102	1	164	395	2.215

Column A gives the number of journals producing a corresponding given number of articles.

Column B gives the corresponding number of articles during the period surveyed.

Column C gives the running sum of the numbers of column A.

Column D gives the running sum of the numbers of column B multiplied by A.

Column E gives the common logarithms of column C numbers.

A glance at these figures shows that in each case there are a few very productive periodicals, a larger number of more moderate producers, and a still larger number of constantly diminishing productivity. In each case, by far the largest number of periodicals give only a single reference during the whole period of the survey. No definite boundaries between the various classes are indicated, but the periodicals can be graded roughly according to the following basis :

- (a) Those producing more than 4 references a year.
- (b) Those producing more than 1 and not more than 4 a year.
- (c) Those producing 1 or less a year.

In the case of applied geophysics (see columns C and D):

In class (a) there are 9 sources producing altogether 429 references.

In class (b) there are 59 sources producing altogether 499 references.

In class (c) there are 258 sources producing altogether 404 references.

In lubrication, assuming that practically all the references relate to the two years 1931 and 1932 only :

In class (a) there are 8 sources producing 110 references.

In class (b) there are 29 sources producing 133 references.

In class (c) there are 127 sources producing 152 references.

The groups thus produce about the same proportion of articles in each case and the number of constituents increases from group to group, by a multiplier which, though by no means constant, approximates fairly closely to the number 5, especially for the two larger groups. This suggests that the running total number of articles given in column D might be proportional to the logarithm of the corresponding number of sources in column C, *i.e.* to the corresponding number in column E. And, in fact, if curves are plotted, as in figure 1, with E as abscissae and D as ordinates for both cases, the later portion of each curve is remarkably close to a straight line. We can thus say that the aggregate of papers in a given subject, apart from those produced by the first group of large producers, is proportional to the logarithm of the number of producers concerned, when these are arranged in order of productivity.

In the diagram, figure 2, let P_1 be the point at which the straight line part of the curve commences. Draw P_1X_1 and P_1Y_1 perpendicular to the axes of X and Y respectively. On OY mark off Y_1Y_2 and Y_2Y_3 each equal OY_1 . Draw Y_2P_2 and Y_3P_3 parallel to Y_1P_1 , cutting the curve in P_2 and P_3 , and draw P_2X_2 and P_3X_3 both parallel to P_1X_1 . Let the distance OX_1 be r units and the equal distances X_1X_2 and X_2X_3 be s units in length. Then, if α , β and γ are the natural numbers corresponding respectively to the logarithmic abscissae

OX_1 , OX_2 and OX_3 we have

$$\log a = r, \text{ or } a = 10^r.$$

$$\log \beta = r + s, \text{ or } \beta = 10^r + s = 10^r \times 10^s.$$

$$\log \gamma = r + 2s, \text{ or } \gamma = 10^r + 2s = 10^r \times (10^s)^2.$$

Putting $10^r = n$, we see that the natural numbers α , β and γ are related to each other as $1 : n : n^2$.

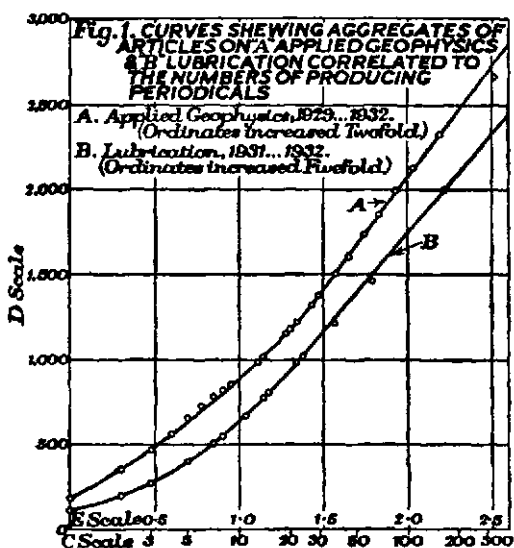
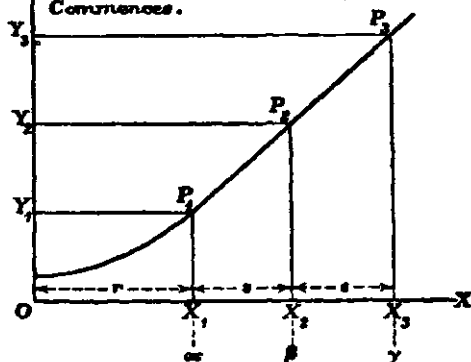


Fig. 2.
 P_1 is the Point at which the Straight Line Section of the Curve $P_1 P_2$ Commences.



The journals in the group represented by OX_1 form a nucleus of those more particularly relating to the subject in question. Therefore, the law of distribution of papers on a given subject in scientific periodicals may thus be stated: if scientific journals are arranged in order of decreasing productivity of articles on a given subject, they may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus, when the numbers of periodicals in the nucleus and succeeding zones will be as $1 : n : n^2 \dots$

The question now arises, what limit can be assigned either to the aggregate of periodicals concerned, or the aggregate of articles produced, in any given subject? We know that the former number cannot exceed the total number of useful current scientific periodicals, say 15,000. But all the data known relate to periodicals, actually discovered to contain useful papers, in preparing bibliographies.

How can we determine whether a mass of periodicals is in fact absolutely sterile in each subject, and how determine the number of periodicals that contain information on a subject?

One approach to this factor is suggested by the scope of the journals that contain useful papers.

On examination, we can establish that the (a) and (b) groups above mentioned are periodicals of scope obviously and *a priori* relevant to the subjects of investigation. They are journals which would almost inevitably suggest themselves as being concerned with these subjects, among others. On the other hand, the (c) groups are found to be very mixed, including some periodicals which, by their scope, we might expect to find more productive; but including also journals of very remote scope in which we should hardly expect to find references. We are surprised, on the one hand, by the lack of productivity of the former, and, on the other hand, by the productivity of the latter. We can only draw the general conclusion that a large number of articles are produced by periodicals which, *a priori*, are "unlikely."

Again, if we examine the annual aggregate of periodicals concerned, we find that each successive year brings forth a new crop of periodicals, and that many periodicals produce a paper one year, but none in later years. In fact, in the applied

geophysics case, each of the four years produced about 40 periodicals which gave a paper one year and none in the other three years.

Also, if we take the successive periods 1929, 1929-1930, 1929-1931 and 1929-1932, *i.e.* one-, two-, three- and four-year periods, it is found that the numbers of references arising from periodicals which produce not more than one article on the subject per annum is, in the four periods, 86, 184, 320, 404 respectively.

As each year produces about 350 articles, it may be deduced that, in any given period of years, the (c) group will produce approximately 25 to 30 per cent. of the total quantity of papers. These will arise from periodicals which fluctuate over a wide range, and may in the aggregate involve a thousand or more periodicals.

It is conceivable that there could be specified in each of the two test cases a list of a thousand periodicals that would include all the producers yet found and all which might be found in a ten years' survey. But there is no means of ascertaining the limit necessary in any given case, and no guarantee that, in the bibliographical work a considerable number of articles have not been ignored.

To get a general idea of the number of periodicals involved, in the lubrication case, it is significant that a very small sample of journals, selected at random from a general list as being possible sources of articles, yielded in a ten-year survey 4 "producers" out of 14. These 4 produced only 15 articles in the ten years, none producing an average of one a year, so that all would come in group (c). Out of these 4, only one actually occurs in the list of producers in the bibliography 1931-1933, and this one is not in fact the greatest producer in the ten-year period tested. These 14 periodicals examined represented a sample, very small naturally, of the aggregate of regular journals dealing with general science, physical and chemical sciences and engineering and industry. This class would exclude periodicals of the annual or semi-annual type, and those dealing with natural history, medicine and other subjects less likely to produce references to lubrication. It might thus represent a sample of 14 from an aggregate of say, 3,000 possible periodicals of the former type. As, out of the

14, 4 were found to be productive, we get, as a *very rough* approximation, a figure of

$$\frac{2}{7} \times 3,000 = 850$$

for the number of productive sources in a ten-year period.

Two more extensive tests were made, each based on an examination of the geophysics and lubrication sections in the subject catalogue of the Science Library during a five-year period, in which about 500 periodicals, on all branches of science and technology, have been indexed. The tests showed that the lubrication references came from 14 periodicals, and the applied geophysical references from 19 periodicals. Assuming that the periodicals indexed by the library represent about

$$\frac{1}{30} = \frac{500}{15,000}$$

of the total number of similar periodicals in existence during the five-year period, we get the figures $14 \times 30 = 420$, and $19 \times 30 = 570$ for the numbers of actual sources of references on lubrication and applied geophysics respectively, in a five-year period. These figures, from a proper 3 per cent. sample of periodicals, are both considerably less than the figure 850 obtained above for lubrication periodicals, which is, however, to be attributed mainly to the difference in the period of the survey, as will be seen.

Other considerations tend to confirm the hypothesis that the number of periodicals containing articles on the subject must increase almost linearly with the period of the survey. The number of known producers contributing not more than one reference a year to the geophysical bibliography were as follows :

86	in the year 1929
155	in the 2-year period 1929-1930
230	in the 3-year period 1929-1931
258	in the 4-year period 1929-1932,

and these form the major portion of the known sources, which were respectively 145, 218, 281 and 326. The increments each successive year are 73, 63 and 45, the last figure being

probably smaller than it should be, because the survey of the literature of 1932 was still incomplete.

It is reasonable to assume that the known geophysical producers would increase over the whole ten-year period, though the increment might tend to diminish each year, say by 10 per cent.

Thus the number of known producers in a period of n years might be

$$S_n = a + (b + br + br^2 + \dots \text{ to } n \text{ terms}) \\ = a + b \frac{(r^n - 1)}{r - 1}$$

where, for the geophysics bibliography,

$$\left. \begin{array}{l} a = 60 \\ b = 85 \\ r = \frac{9}{10} \end{array} \right\} \text{approximately}$$

giving

$$S_n = 60 + 850(1 - 0.9^n)$$

or in the limit, the total number of productive periodicals,

$$S_\infty = 910.$$

Now, putting $n = 5$ and 10, successively, we have, for applied geophysics,

$$\begin{array}{l} S_5 = 410 \\ S_{10} = 615. \end{array}$$

These are the "bibliographical" or "known" sources.

For lubrication, we know that a two-year survey produced 164 bibliographical sources compared with the 218 of applied geophysics, say 25 per cent. less. We can, therefore, assume for lubrication

$$\begin{array}{l} S_5 = 310 \\ S_{10} = 460. \end{array}$$

Comparing S_6 here with the value $S'_5 = 420$ estimated for the actual sources, we get a figure

$$S_{10} = 460 \times \frac{420}{310} = 620$$

for the actual or total sources in lubrication, on a ten-year basis. Considering the approximate character of the analysis, this figure is sufficiently comparable with the 850 obtained above.

It seems safe to say, therefore, that the number of journals which contain articles on the subjects in question is of the order of a thousand. But the periodicals themselves could not be specified without scrutinising a much larger number of periodicals during a long period. And, even when the actual producers during a period of years had been ascertained, new sources would certainly appear during a further period. It follows that the only way to glean all the articles on these subjects would be to scrutinise continually several thousands of journals, the bulk of which would yield only occasional references or none at all. And because this work is altogether impracticable, a large portion of the total number of references on a given subject is regularly missed by the abstracting journals.

For the same reasons special libraries cannot gather together the complete literature of their subject, except by relinquishing altogether their specific character and becoming practically general libraries of science. Detailed analysis showed that in practice one-third of the contents of special libraries is usually related definitely to their own scope, the remaining two-thirds comprising literature on border-line and less related subjects. These publications are duplicated in many other libraries, and their representation in any one is altogether inadequate.

The law deduced conforms to the mathematician's criterion of being of no possible practical use whatever. But it does show why abstracting periodicals are not complete and points out that, to remove the incompleteness, every useful article in every scientific periodical should be scrutinised, irrespective of the subject of the article.

The verification of the proportion of articles not indexed. To complete this investigation, it needs to locate some of the mass of hidden articles on a given subject, which are not indexed by the reference-making periodicals, and to make an independent estimate of the number of these articles from the articles themselves.

It has been shown how some of these articles were found in lubrication. Similar searches were made also in some other subjects such as chemistry and agriculture. To get a more reliable indication of their extent, it was required to deal with them in bulk. One of the largest groups of abstracting agencies, dealing with a single subject in *applied science*, was selected, because of the thoroughness of their abstracting. To avoid offence, the subject shall be nameless. We shall call it "S." One of the largest abstracting bureaux in *pure science* kindly allowed its abstractors to scrutinise the periodicals they dealt with for their special subject, we shall call it "R," and to pick out all articles in these periodicals that were of interest for the remotely related subject S. The number of articles a year, relating to the subject S and not abstracted by its own group of agencies, was found to be about 1,200. These were obtained from a group of 451 periodicals regularly scanned by the abstractors for the subject R. This number corresponds to an aggregate of nearly 40,000 articles on the subject S in the total 15,000 useful scientific periodicals. While the total number of the abstracts on the subject S, produced by its own bureaux, was only 20,000. So that they abstracted only about one-third of the useful articles in their special field.

We are forced to the conclusion that less than half the useful papers are noticed in the current abstracting and indexing periodicals.

CHAPTER X

A PLAN FOR COMPLETE SCIENTIFIC DOCUMENTATION

It has been estimated that in one year as many as 15,000 useful scientific periodicals are published, and that these contain about 750,000 useful articles. Whilst three hundred abstracting and indexing periodicals which appear during a similar period, include together about the same number of references to these useful articles, but cover less than half of them, although they scrutinise, between them, nearly all the useful periodicals. It follows, therefore, that enough work is being done to abstract or index all the useful articles published, if only this energy were rightly directed.

The cause of the present deplorable situation in abstracting has been shown to be the scattering of useful articles on any one subject throughout the mass of current periodicals, according to a general law, which has been deduced. Articles of interest for a special subject occur not only in the periodicals more particularly devoted to that particular subject or the next more general subject of which it forms a part, but, also, from time to time, in other less related periodicals, which increase in number as the relation of their fields to that of the particular subject decreases, and the frequency of articles on that subject in each periodical diminishes. It is necessary to quote only a couple of examples to show how this occurs. Anyone interested in the electrical conductivity of soils, would find essential information in periodicals devoted to general science, physics, chemistry, geology, agriculture, engineering, electrical engineering, telegraphy, telephony, radio-communication, etc. Or, a specialist, needing information on the molecular structure of frictional surfaces, should be able to find it in periodicals devoted to general science, general physics,

molecular physics, colloids, general chemistry, including theoretical and physical chemistry, geophysics, general engineering, as well as civil, railway and constructional engineering, chemical technology, metallurgy, fine mechanisms and various manufactures. Instances of this kind of interlocking of the sciences could be multiplied to any extent.

Abstracting services concentrate upon the comparatively few periodicals where many articles on the subject may be expected and ignore the very large remainder, where the frequency of the articles is far less, but the aggregate of articles is greater. It would be impracticable for them to do otherwise. To pick out all the articles on a subject would involve the scrutiny of many thousand periodicals, most of which would certainly contain less than one article a year. The same periodicals would need to be scrutinised again from other points of view by other independent abstracting agencies : an obviously time-wasting task, which they do not attempt. The result is that a majority of the useful articles is missed.

This inefficiency depends to some extent on the detached outlook of the individual abstracting services, concerned only with their special fields. Amalgamation with other abstracting services, such as the recent amalgamation of Physiological Abstracts with British Abstracts, will, doubtless, bring about an improvement. Complete amalgamation of all the abstracting services would obviously eliminate duplicate abstracts and produce complete documentation, without additional labour, or expense, because, as it is, enough abstracts are produced already to cover every useful paper.

By itself, this illuminating fact is an answer to the prevalent objection that several different abstracts of the same paper are required from different points of view : that we cannot afford to abolish these : and, therefore, that adequately to abstract every paper would need more labour than is already available and would cost so much the more. There are several other answers to this objection. An obvious one is that, if we need more labour, it ought to be supplied. The funds to finance it might be obtained from various sources, especially from Unesco. Or the larger publications resulting might be sold at higher prices and so produce greater income. Or, again,

the adoption of the Universal Decimal Classification would considerably reduce the cost of production. Further, if it is true, as the abstracting bodies generally maintain, that they abstract already all the most important articles, then the missing articles would require shorter abstracts, or some, only annotated references. So that the extra cost would be smaller in proportion and more easily to be covered by any saving in the cost of production. Finally, examination of the fields of the abstracting journals leaves no remaining doubt that the majority of the multiple abstracts are not made from different points of view and are entirely redundant.

The one real excuse for duplicating abstracts is to make them available in different languages. There is, of course, much to be said for this. But it is not the main cause of the duplication. German is the most important language, besides English, in which abstracts are usually made. There are few abstracts made in other languages. It is possible to imagine that an abstract should be made in English, or in German, and then merely translated into the other language, instead of making two different abstracts. There is, however, no substantial reason why separate sets of abstracts should be made in the same language in England and America. Already some degree of agreement has been reached between English and American abstracting bodies to share abstracts between them. With the exception of a few commercial indexes, abstracting periodicals are not generally such great sources of revenue, that there should be serious reluctance to join forces. There is no doubt that, with increasing goodwill on both sides of the Atlantic, the tendency to amalgamation will increase, to the great advantage of our art.

Evidently this is the direction in which we should endeavour to progress. Time will be needed to attain the journey's end. In the meantime, there is a possible step towards complete documentation that we might take now. We have seen that the abstracting periodicals, between them, take all the most important periodicals. All the useful periodicals might be divided into small groups, more or less according to the subjects actually treated by existing abstracting agencies. These small groups would not contain as many periodicals as are regularly scrutinised by any single agency, but only a pro-

portion of them. Each agency would then agree to undertake to be responsible for indexing every useful article in its particular small group of journals. It would continue to abstract all the articles in these periodicals that it would have dealt with in its ordinary routine and would pass on to the appropriate agency for that agency to deal with all articles it would not itself have dealt with. By this procedure, every useful article in every group would have attention.

Usually, all periodicals taken by an agency are scrutinised and articles for abstracting are marked in some way. The only extra work involved would be to indicate, by short two-figure numbers, the articles to be considered by the other agencies and to let a clerk send them by post. There would be no interference with the routine of any agency. It would be free to take in and abstract any other journals that it liked, or funds permitted, to use any system it might prefer, or to publish its abstracts in any format. Merely to pass on the articles not within its proper scope is all that is required. And no check that this had been correctly done would be needed. Any very small loss occurring would be absolutely negligible, compared with the enormous waste of articles at present. By collaborating in this way, actual amalgamation of the co-operating bodies would automatically be brought the nearer, so that gradually, and in course of years, it might become complete.

The thought naturally occurs that meantime, the number of papers to be abstracted that would be brought to the notice of abstracting agencies would necessarily increase. That to abstract twice as many papers would involve twice the amount of work. Such a large increase is not involved, however. The small group of periodicals, from which articles were passed on, would be less than the whole group of those regularly scrutinised and only some of the articles would be passed on. The aggregate of articles received by all the abstracting agencies would correspond to that of those passed on, and, on the average, this would apply also to each abstracting agency. All the articles received would not be of first-class importance and would not need full-length abstracts and some would require mention only. The total increase might be, at the outside, fifty per cent. and this would not be realised

until all the abstracting journals had agreed to take part in the scheme, which could only be a gradual process. Against this gradual increase would be set great savings in the number of abstracts needed, and increased returns from the sale of larger volumes containing more abstracts. While, for those who had not previously employed the Universal Decimal Classification, there would remain a very considerable saving in the cost of production, resulting from its use. Altogether there does not seem to be much that would be very terrible to fear from the increase in the size of the abstracting journals.

On the other hand, there would, most certainly, be substantial gains. As each abstracting periodical became more and more complete, scientific workers would be provided with so much the more complete references to past and current work; so much the more wasted effort in repeating experiments already made would be saved; and so much the more rapidly would discovery and invention grow.

Some of the advantages of collaboration have been realised already by some abstracting bureaux. For years there has been a noticeable tendency towards amalgamation. So far, the biggest and most recent event has been the formation in 1946 of a Joint Committee of *British Abstracts* and *Science Abstracts* to consider plans for closer co-operation between the two bodies, with a view to avoiding undue overlapping of effort and with the power to co-opt representatives of other abstracting services.

This, then, is the plan which was adopted by the British Society for International Bibliography in 1944 and by the International Federation for Documentation when, at its first post-war International Conference on Documentation at Paris in November, 1946, a small international committee was appointed to promote it. It will be seen that the adoption of the Universal Decimal Classification is now not obligatory in the plan. It becomes only a great labour-saving instrument, facilitating the subject-indexing and finding of the abstracts. The original idea of the founders of the International Federation for Documentation remains, by which abstracting and indexing organisations and individuals were to be induced to co-operate by using the same classification, so that all their bibliographical references could be brought together into one

index. Great progress has been made in securing the adoption of the Universal Decimal Classification for this purpose. It is used by a large number of abstracting and indexing agencies in Europe, which produce together more than 130,000 references annually, while business firms, libraries and information services file, perhaps, twice as many references internally each year. We are nearing the time when we shall be able to say that every different paper abstracted receives its Universal Decimal Classification number. As we have seen, however, this alone will not suffice. We have still to arrange that every different paper is abstracted. For this the larger plan is needed.

There will remain a residue of other literature to be dealt with. This includes books, of which some twelve thousand volumes appear each year in the scientific field, and patent specifications, amounting to perhaps two hundred thousand annually.

The cataloguing of books and new issues of periodical publications is essentially a matter for trained librarians. No one else can treat them adequately. It takes five years to train a competent cataloguer. Fortunately, there are a number of large general scientific libraries in various countries where scientific books and periodicals are collected. The ideal would be to make some of these complete. The catalogues of such libraries, properly classified by the Universal Decimal Classification, with their weekly lists of accessions as, for example, that of the Science Library at South Kensington, are the solution to the problem of subject indexing scientific books and new periodicals.

Patent literature is a further problem. It contains a mass of information about new discoveries and inventions that is not elsewhere published. All the national Patent Offices have their own special ways of classifying patents, which is, of course, unnecessary and unfortunate. They should be persuaded to adopt the Universal Decimal Classification, or at least to add the decimal classification numbers, in addition, to their specifications and abridgments. The Dutch Patent Office has already done so. This would make an invaluable mass of scientific information readily available and make it possible to intercalate the patent specifications of different countries in one series for much greater ease of search.

The mass of manufacturers' catalogues have been suggested as more material to be dealt with. There are so many of them that it is not easy to find out who makes a certain object, or even if it is made at all. It would seem to be in the interest of manufacturers themselves to add its Universal Decimal Classification number to each manufactured product in their lists. Libraries could then file the catalogues in the order of the classification numbers and keep them, uncatalogued, in pamphlet boxes for ready reference, with no extra trouble to the library staff. It has been suggested that these catalogues should be properly catalogued and classified by some central organisation. In my opinion such work would not be justified. The manufacturers might well be asked to help themselves and save other people this onerous task.

And so we see how the world's output of scientific literature could be adequately treated. Like all great things, the plan suggested is absolutely simple. In fact, so simple that some people wonder if it could suffice. Let these consider carefully what difficulties could possibly arise and, if they cannot state them, let us all agree to work together on the simple plan. We have seen that the skilled labour necessary to index the annual output of recorded scientific information is available. It needs only to be rightly organised. This means we must all undergo the slight inconvenience of submitting to a minimum of regulation, so as to obtain the maximum benefit from the labour expended. This is the principle that has come down to us through the ages in the familiar words "Union is Strength."

Law does not put the least restraint
 Upon our freedom, but maintains 't.
 Or, if it does, t'is for our good,
 To give us freer latitude.

We can have our index, if we really want it.

There may be some who would, inadvertently, retard our efforts by suggesting that we should ignore the careful work that is being carried on to-day to abstract scientific literature. "Abstracts," they say, "are no use to the real research worker. He must consult continually, the original documents. Let us concentrate on making a complete index, without abstracts, and have done with it."

There are two equally cogent replies to this suggestion. It is, of course, quite true that an experimentalist needs to consult the original records of past work. But he does not need to consult them all. The abstract serves two purposes: it gives to a hard-working teacher, a synopsis of current progress without having to read all the records and so gives him leisure to pursue his original researches; it tells him, also, what papers he does not need to study. Even on his special subject, there are many papers which are no use from his particular point of view. The abstract usually shows the way in which the author treats the subject and so saves the investigator wasting time in reading papers of no value to him. We cannot do without abstracts, as was demonstrated, once for all, by the fate of the International Catalogue of Scientific Literature. The other argument is that no one has attempted to estimate the cost of a complete index, without abstracts. From experience in the Science Library, where we produced the not inconsiderable number of 20,000 bibliographical references annually, it is possible to calculate that it would cost £150,000 a year. Such unnecessary expenditure would be inexcusable.

There are some others who profess to realise the need for collaboration with existing agencies. They do not explain, however, how they propose to attain this end. The index they propose is to be organised by countries. While the abstracting bureaux arrange their work by subjects. The simplest manner of combining these two, almost incompatible, procedures, would be, perhaps, for the abstracting agencies to pass on the articles not within their respective provinces to the headquarters of the proposed new international organisation instead of to their sister agencies. This would, of course, make our proposed plan unrealisable. But no matter. The proposed new international organisation would mark the individual articles received, with two-figure decimal numbers, sort them and send them to their expert classifiers. These individuals would proceed to read the articles, write out the titles and references and add the full classification numbers. The classified titles would then be sorted into numerical order and sent to the printer. This work would cost considerably less than the last scheme, because there would be fewer articles

to be dealt with and two sets of periodicals would not have to be purchased. The actual cost is estimated at £65,000 annually for 500,000 articles, in an edition of 500 copies.

In practice, there is little doubt that the resulting partial catalogue would be less used even than was the International Catalogue of Scientific Literature. It would not have abstracts and would not include the cream of the articles. To make it saleable at all, the whole of the articles would need to be included and this would immediately increase the cost to £150,000 a year. We are obliged to conclude that to collaborate with the abstracting agencies is not practicable, except in accordance with the plan worked out by the International Federation for Documentation.

CHAPTER XI

SOME GENERAL PRINCIPLES OF A BIBLIOGRAPHICAL CLASSIFICATION SCHEME, WITH SOME SUGGESTIONS FOR EVENTUALLY IMPROVING THE UNIVERSAL DECIMAL CLASSIFICATION

MANY bibliographers will be aware that the honorary secretary of the International Commission of the Universal Decimal Classification, Heer F. Donker-Duyvis, in his *Fourth Report of the Commission internationale de la classification décimale*, has described two methods of improving the schedules of the Classification. The first is called the method of starvation. Its practice is that : if, under a certain general heading, such as 665, illuminating industries, some subdivisions have grown out of date ; these subdivisions are transferred to new decimal numbers, which are not in use ; the old subdivisions are not suppressed immediately ; those, who used them before, may continue so to do, if they wish, until an opportunity occurs to take up the new numbers ; so the old numbers gradually starve, and, after ten years, they may be used for new subdivisions. The old 665 section was a hotchpotch of lighting appliances, animal and vegetable oils, and mineral oils, and gases. The section had become quite out of date. Animal and vegetable oils are now more used as foodstuffs, and mineral oils as lubricants. Even coal gas has become more useful as a fuel and raw material for chemical industry. It is being replaced, for illumination, by electricity. So, in the last French edition of the Decimal Classification, the 665 section became "Oils, fats and waxes. Illuminating gases." The topics concerning illuminating engineering were brought under 628.9 and the oil lamps into ironmongery. Thus two

large subdivisions 665·6 and 665·9 were freed and can now be used for cognate industries, as soap-making.

The second method of improvement is, by complete revision of the schedules from the first to last. Heer Donker-Duyvis points out, however, that gradual changes are in progress in our outlook on the theory of systems of classification. Monistic, and consequently analytical, conceptions are giving way to universal and synthetic notions. While once we taught pure science only in our universities, we now teach applied science too. More and more, chemistry includes chemical technology. One day we may study mining with geology, and electro-technology and electricity be united as one subject. This change is taking place. It is not, as yet, complete. Therefore, Heer Donker-Duyvis concludes, the time for such a drastic change as complete revision of the schedules is not yet. When we undertake complete revision, it would be possible to do away with all auxiliary signs and letters and achieve a pure decimal notation, with, also, shorter numbers than at present.

In the meantime, simplification is possible by the method of starvation: the suggestion being, that we should aim at pure decimal notation and adopt, meanwhile, the compromise of decimal numbers with a few letters added, as additional digits. First let us try to realise the nature of a bibliographical classification scheme. Much has been written about classification. Many classification schemes have been devised in search for the ideal. But it would seem that much of the writings and many of the schemes have been composed from the pure academic point of view, or, may be, that of classifying books in libraries, without regard for the use of a classification scheme as a means of co-operation by bibliographers in subject-indexing of recorded information, so that all, relating to a special subject, may be found at need. Most documentalists know well that to index completely by subject the records of discovery and invention, needs the full co-operation of many bibliographers, and that, in order that the references, these bibliographers produce, may be combined, a standard system must be used. Therefore, we define a bibliographical classification system, as one that may be used as standard to enable the co-operation of the bibliographers in indexing, by subject, the whole output of the literature it is worth while to index.

Next, we may ask, why do we need a classification scheme for this purpose? Would it not be enough to prepare just a list of all subjects, without any regard to their order, or arranged alphabetically, and to give to each subject, for filing and finding, a sign in some series of recognized order, as Roman small letters or Arabic numbers. We know that the fatal objection is that, even if all synonyms were rigorously ruled from our list, related topics would be scattered hopelessly, and we should be obliged to introduce a complicated system of cross-references, which would be nothing less than a concealed classification scheme. This hidden classification would have to be compiled with just as much care as an open classification scheme. The latter would bring related references together, and save sending the searcher backwards and forwards and upstairs and downstairs, in a labyrinth of irritating cross-references among even a few million cards. We are forced to conclude that a classification is essential to an efficient subject-index to recorded information.

We come back to our inquiry, what is a bibliographical classification scheme? Pronouncements by some would-be makers of ideal classifications are not always possessed of the greatest clarity. They say, for example, that "what we call nature and what we experience as life are so complex that our statement of what we know or think of them must be simplified in some measure. . . . Generalisation, on which science and philosophy depend, is a kind of simplification, in that it abstracts the general, essential, and characteristic from the complex of changing realities. Abstraction and generalisation are mental processes, of which the mental products are concepts and their correlative classes. Classification thus depends on generalisation."

If we may take "what we experience as life" to mean our experience as living beings, the argument would seem to be: the universe is so complex that we must use some sort of simplification in describing it. One method of simplification is generalisation. This is a mental process, which produces concepts and classes mutually related to them in some way. Therefore, classification depends on generalisation. This may be true, provided classification depends in any way on making classes, as we might assume. But it leaves us in the dark as

to the way in which classification is related to generalisation. In contrast, clear sound common sense is written by Mr. Berwick Sayers in his excellent text-book *An Introduction to Library Classification*, where he says, the term "classification" is now used indifferently for several processes. Its simplest meaning is that process of the mind, by which qualities in things are grouped by those qualities into classes. But, conventionally it is now used for :

- (1) the mental process of recognition and grouping ;
- (2) the act of arranging groups, or classes, in some order ;
- (3) the lists of terms of a classification scheme, which, more correctly, should be called the "schedules" of a classification scheme ; and
- (4) the act, or art, of determining the place, in which a thing should go in a classification scheme. Strictly this is "classing."

We note that the third aspect of the word, or the lists of the terms of a classification scheme, is what we are now to discuss.

To proceed, we shall define a class as a set of beings or things, having something in common.

For convenience in co-operation, as well as for filing and finding, we use signs as shorthand symbols to denote the classes of our classification scheme. A sign is an arbitrary mark, having a fixed interpretation and susceptible of combination with other signs, in subjection to fixed rules, dependent upon their mutual interpretation. And, since words, as man's chosen symbols of expression, are also signs, we see, at once, that there is a close analogy between a language and a classification scheme. To understand the latter better, we may pursue this close analogy. In his great book *The Laws of Thought*, 1854, George Boole points out that all the operations of language, as an instrument of reasoning, may be conducted by a system of signs composed of the following elements, viz. :

- (1) Literal symbols, x, y , etc., representing things as subjects of our conceptions ;
- (2) Signs of operation, as $+, -, \times$, standing for those

operations of the mind, by which the conceptions of things are combined, or resolved, to form new conceptions involving the same elements, and

(3) The sign of equality.

The first class of appellative, or descriptive signs, expresses either the name of a thing, or some quality, or circumstance relating to it, *i.e.* they represent substantives and adjectives.

Thus, both in logic and in classification schemes, we may agree to represent the class of individuals, to which a particular name, or description, is applicable, by a single letter, such as x . If the name be men, then x will represent all men, or the class man, and, if an adjective, as "good," be added, as a descriptive term, we can denote by a letter y , all things to which the description "good" applies. If we then agree that, by the combination xy , shall be represented that class of things to which the names, or descriptions, denoted by x and y are *simultaneously* applicable, then xy means "good men."

It is evident that the order in which two letters are written is indifferent, *i.e.*

$$xy = yx$$

Similarly, three letters, written together, represent all the objects, or individuals, to which the several meanings of the letters simultaneously apply, and the meaning is the same, regardless of the order of the letters. The letters are commutative like the symbols of algebra, and we note that such combinations of letters correspond to decimal classification numbers united by colons.

The signs of the second class denote those mental operations, or classing processes, whereby we collect parts into a whole, or separate a whole into its parts. In thought, we form an aggregate conception of a group of objects, each of which is separately described. For this purpose we employ conjunctions, such as "and," or "or," *e.g.* "trees and minerals." These conjunctions are analogous to the $+$ sign in algebra.

Similarly, in logic, we may separate a part from a whole. This operation we express by the symbol "except," as "all men except Asiatics." We may express this negative process by the minus sign. It will be seen that these signs are

distributive in operation. Thus

$$x + y = y + x$$

and

$$x - y = -y + x.$$

The equals sign of the third class represents, in logic, the substantive verb "is" or "are."

The equals sign is not used in this sense in the Decimal Classification. But the use of other signs for verbs has been proposed and the analogy between a language and the Decimal Classification has thus been made still more complete.

We must now deduce a fundamental property of signs, as representing substantives, or classes. The combination of two signs, as xy , represents that class of things, or beings, which is common to both classes x and y . This class is necessarily smaller than either of the two classes separately. Now suppose that one class, y , is gradually increased, so that it contains more and more of x . It will also hold some other things that are not part of x . Let these be gradually removed. As y approaches x more closely, the class, xy , becomes larger and more nearly equal to x . Finally, when y becomes equal to x , the class xy , which is now x^2 , also becomes equal to x . And so we deduce the equation

$$x^2 = x,$$

which is the basis of Boole's calculus of logic. The equation may be written

$$x - x^2 = 0,$$

or,

$$x(1 - x) = 0.$$

To interpret this equation, we have to notice that

$$1x = x,$$

and if 1 denotes a class, the only class including all of every class, whatever x may be, is the universe of discourse. Thus, we see that 1 denotes the universe of discourse. That is why, in the Decimal Classification, unity is used to signify the whole of knowledge. We can now interpret the equation

$$x(1 - x) = 0.$$

For $1 - x$ means all things except x , and, so, the equation means that the class that contains those individuals, which are common to the class x and to the class, which does not contain any individuals of the class x , does not exist.

We have, therefore, the law that "It is impossible that the same quality should both belong to and not belong to the same thing," which is Aristotle's Principle of Contradiction, which he regarded as the most certain of all principles.

The fact that this equation is of the second degree, with two roots, 0 and 1, indicates that we perform the process of classification, by separation into pairs of opposites, *e.g.* men and not men, and we notice that only values 0 and 1, apply to whatever class we designate by any symbol x .

So, if x represent any class, as men, its individuals will have many different qualities. We may separate those individuals, which are distinguishable from one another as having different qualities, in sub-classes. The symbols of all sub-classes will have only the possible numerical values 0 and 1. So let us draw straight lines, of unit length, from a convenient point, to represent these symbols. The lines will be distinguished by direction, and, if we like to use a space of three dimensions, the unit lines will terminate in points upon the surface of a unit sphere. The aggregate of points will represent the class of beings, men. Similarly, let more lines be drawn to represent all things we wish to talk about. The aggregate of points, where all these lines end on the surface of the sphere, represents the universe of discourse. If we think of certain men as specified by redness, there will be points that correspond to red men. There will be, also, other points that correspond to other things that have the property of redness: as roses, wine and chimney pots. Whatever qualities we choose to specify a class, some of those qualities are likely to belong to other things outside that class. And so we get a picture of the universe of discourse as a globe, on which are scattered, in promiscuous confusion, the mutually related, separate things we see or think about.

The reader may suggest that the centre of the globe denotes those nether regions that will be the ultimate abode of those estimable librarians and bibliographers, who are described as knowing progressively less and less about more and more.

To make a classification scheme, we pick out groups of qualities belonging to the subjects of our discourse, in any ways that seem to us appropriate; we select the individuals, x , that have those qualities and reject all others, $1 - x$, that do

not. The selected items form our classes. Having made our classes, we repeat the process with the classes, forming groups of classes, and then again with groups of classes, and so on, till we have exhausted what we know of things. Alternatively, we may divide all knowledge into groups and subdivide those groups, until we have obtained divisions small enough. Thus, a classification schedule is a list of names of subjects in some order and divided into classes.

The first point to be noted is that the smallest classes and the largest groups are not continuous. They are just collections of discrete items, or of groups of separate items. The schedules of classification do not correspond to a continuous line, an area or a volume, merely to convenient groups of sets of composite points. Moreover, we select our classes only by those qualities that we have learnt to recognise. There will always be a residue, $1 - \Sigma x$, of qualities we do not know. And, so, our classification schedules cannot be complete until we have acquired a perfect understanding of the universe.

It is evident, again, that we can choose the qualities that specify our classes in many different ways, each choice producing a section in our schedule. Thus we can think of ships, according to their building materials : as wooden ships, iron ships, steel ships and ships made of other materials. We may regard ships in respect of their means of propulsion : as by hand, by wind, by steam, by electricity, or oil. Again, we may classify ships according to their use : for pleasure, for carrying passengers, or troops, for transporting cargo, or to fight the enemy. These sections are not mutually exclusive, but, is one of them more logical than another ? Or, are they not all needed in a practical classification scheme ? Thus we see that mutual exclusiveness of classes is not always practicable. Nor, is there any such thing as "The order of nature," so often invoked by would be classification constructors. The best order depends on our outlook and our state of knowledge. One single example will suffice to prove this, *i.e.* that while older classification makers placed Religion early in their main divisions, the modern artist puts it nearly last, and after History.

For bibliographical purposes, then, we need a standard classification scheme that :

- (1) Brings together closely related classes ;
- (2) Is sufficiently subdivided to index everything we write about, or study ;
- (3) Is capable of further extension and subdivision, as our knowledge grows ;
- (4) Is recognised widely, in order that users may find their way about it easily ;
- (5) Has extensive indexes of the names of its classes in alphabetical order in different languages ;
- (6) Is not subject to frequent reconstruction ; and
- (7) Has the simplest notation, for ease of inserting and finding the classified entries.

Since a bibliographical classification is only a means of code-marking references for quick filing and finding, it is not concerned with academic questions, as to what may be the most logical scheme. Once adopted, it cannot remain completely logical, without continual change, as knowledge grows, which change would make it useless as a standard. All that is needed is that new divisions are forthcoming as they may be wanted. When classes become out of date, they can be reconstructed by the process of starvation. And, as the Decimal Classification combines all these requisites, it fulfils all the needs of a bibliographical classification scheme.

Two real objections have been urged against it :

- (1) That its notation is too complicated, and
- (2) That its schedules are not up to date.

The second objection is the fault of the critics themselves. They have merely to establish the necessity for new divisions and these will be made, the more quickly, if the critics should be willing to help in the process. The first objection can be met as follows. It is established that the best notation for a classification is a system of pure decimal numbers, because these are the easiest to file and find. In the last edition of the Decimal Classification there were some eighty thousand main divisions, for which five or six figures would suffice. Instead, the artists of the Dewey system, on which our own is based,

made the too usual mistake of not realizing how little we know of what is to be known, and, so, they used up all nine Arabic figures in making their main headings, leaving no room at all for new subdivisions, except by further division of old sections. This was the cause of the very long numbers we now have to use.

If we wish to avoid complete reconstruction, the obvious remedy is the addition of literal digits. The use of Roman letters as new digits is accepted in arithmetic in scales of notation, and Roman letters seem the simplest for our purpose. Only one or two are needed. But, at once, this leads to the suggestion that, as Roman letters have an accepted order, their substitution for the signs at present used for the auxiliary tables would not merely simplify the aspect of the symbols, but would exchange a recognized for an arbitrary sequence of the signs.

It is, therefore, proposed to substitute six Roman lower case letters for the symbols of the general divisions and to add two other letters, m and n, as new digits for providing new fixed classes, as required.

However, when we come to make this substitution, we immediately discover a serious error in the order of the auxiliary and analytical signs. The present mode of alphabetical division by the capital letters A/Z comes in the middle of the general signs; between inverted commas and the hyphen. But the basic idea of these tables is that they are all general classes that relate to a number of main headings, and may be applied to any of these headings, or to certain groups of headings. Without discussing whether this idea is sound, we may accept the definition for the moment. On the other hand, the letters A/Z in capitals are used to make new fixed divisions of given main divisions. For example *Cardiidae*, a class of molluscs, 594·151, is subdivided by the A/Z divisions to make a fixed division, 594·151 *Cardium*. And, if we wish to use the general division, ·08 in 594·08, to indicate experiments on the whole section *Cardiidae* 594·151, we add the ·08 to 594·151, as 594·15108. And this compound expression should be filed before 594·151 *Cardium*, because it means experiments on the whole class 594·151, and not only on the sub-section 594·151 *Cardium*. Yet the old rules put A/Z before the analytical divisions.

If we agree that the A/Z divisions should come after the

analytical divisions with —, ·00 and ·0, we see that the A/Z method is, in fact, alternative to subdivision by an extra decimal place. So, putting six lower case letters for the old auxiliary and analytical divisions and adding two other letters for making new divisions, we get, instead of :

<i>the present sequence</i>		<i>the simpler sequence</i>	
main number		main number	
:		:	
=		a	
()		c	
“ ”		d	
A/Z		e	} general
—		f	subdivisions
·00		g	
·0		A/Z	
·1/9		m, n	
		·1/9	} fixed
			subdivisions

which may be written simply :

main number, :, a/z, ·1/9,

because the capital A/Z is alternative to the “ duodecimal ” divisions.

In this simple sequence, which is the order of the universally recognized Roman alphabet and Arabic numerals, first after the main number, comes the colon, as before. This is the means of joining two main numbers and corresponds to Boole’s conjunction of two literal symbols, as xy . It will be seen that the multiplication sign, \times , read as “ into ” or “ cross,” would be more rational to use instead. It would have the advantage, also, of being more striking to the eye, and would eliminate a favourite gambit of the printer, namely printing a decimal point for the colon, to catch the unwary proof reader.

After the colon, come the general divisions, specified by lower case Roman letters, which in many cases save a sign, or two, in printing. Following the general divisions, come the alternative means of division by capital A/Z, or by a further “ duodecimal ” place.

These proposed changes would simplify the notation of our classification and provide the possibility of much shortened signs. They cannot be adopted without careful consideration by the International Commission of the Classification.

CHAPTER XII

FOR AND AGAINST THE DECIMAL CLASSIFICATION

It will be remembered that Chesterton wrote : " It is a staring psychological fact that there are some things a man . . . likes to do for himself . . . inventively, creatively, artistically, individually . . . in a word badly." Although the progress of civilisation has involved the introduction of a measure of economic control, so that men may work together for the general good, the power of choice has remained the prerogative of free men since the advent of mankind.

This psychological fact applies to bibliography, as to every art and occupation of life. It is as natural for a bibliographer to prefer his own methods as it is for an artist to like to develop his own style. But, with the growth of experience in every art and science, each one evolves a technique of its own, to which its would-be addicts must subscribe. A bibliographer can no more afford to neglect the principles that have been established in the practice of his younger profession, than it would profit an artist to ignore the canons of his art.

I believe that opposition to the Decimal Classification has sprung in the main from this dislike of free men to any kind of regulation. The volume of criticism in the past is a measure of the progress made in the use of the classification, and the occasional resort to anger and abuse expresses the discomfiture of the critics.

Let us try to understand why a minimum of control is essential to efficient bibliography. We know that the output of books, monographs, pamphlets, original articles in periodicals, patent specifications, reports and other forms of document, is altogether beyond the compass of a single bibliographer. We know, too, that the inter-relations of different branches of knowledge are so intimate that no section

of the whole mass of literature can be made that will certainly include all that has been recorded about a particular branch of knowledge, however small. Any single topic has so many aspects and ramifications that information about it may be contained in volumes treating, in the main, quite different subjects. To pick out all the information about a particular topic, the whole mass of literature must be searched.

It is true that knowledge can be divided into very large groups, *e.g.* religion, science, etc., which do not overlap very much, although they have some inter-relation. It is possible to restrict our search to such large groups, without losing a great deal of value. But these groups themselves are still beyond the capacity of a single bibliographer. The conclusion is inescapable that collaboration is essential to the production of a complete index to all the useful information about any subject. This conclusion is fundamental and is confirmed by the most extensive analysis.

But, if collaboration is necessary, it must be organized. There is no collaboration between a crowd of individuals, each working according to his own ideas, each attempting to scrutinise the whole of the literature that may contain references to his particular subject. Inevitably useful information will be missed and work will be duplicated. To co-ordinate the labour of many agents, so that their references can be fitted into one index, we need first, the adoption of the same bibliographical classification, and, secondly, to secure that the whole of the literature is scrutinised. As the number of bibliographical references made in the field of science is equal to the number of original articles published, there is no physical impossibility in making one reference to every article in this field. The fact that, only about one-third of published scientific articles of value is indexed, indicates the need for collaboration in bibliography.

The use of a standard classification, as a means of unifying the work of many bibliographers, is comparable with the adoption of traffic regulations to prevent road blocks. How many motorists would get to Epsom on Derby day without definite rules of the road? The difference in the two cases of economic control is that a bibliographer may choose to make his work form part of a comprehensive index by subscribing to the

standard classification, while a driver is compelled to observe the traffic regulations.

The combination of the two bibliographical requisites of a standard classification and the complete scrutiny of a more or less definite mass of literature was adopted by the Royal Society for producing the *International Catalogue of Scientific Literature*. The value of this catalogue, most useful as it was, was somewhat impaired by the employment of an imperfect classification and an incomplete collection of literature. A complete subject catalogue of scientific and technical literature to-day would be some seven times as large. The fact that the catalogue was carried on for many years shows that such an undertaking is not physically impossible, as critics sometimes allege.

The method, advocated by the International Federation for Documentation, is the willing co-operation of existing specialist bibliographical undertakings; thus avoiding duplication of the labour already being expended on the task by specialist bibliographers, as well as the great additional expense of setting up a central organisation to do their work again. Needless to say, the classification adopted for the purpose is the Universal Decimal Classification, which has been elaborated for this task and is now generally recognized internationally.

We see, then, that the purpose of the Universal Decimal Classification is merely to co-ordinate the work of many bibliographers, so that the entries, they prepare, automatically form part of a single comprehensive index to recorded information. Other uses of the Classification are possible and may be desirable, but they are entirely subsidiary to this main purpose and must never be confused with it. A particular biologist might find the Classification of the greatest use in arranging his large collection of microscope slides. A librarian may adopt the scheme as a very useful means of arranging his books. An engineer might well employ the Classification for keeping in order his great array of workshop tools. Such uses, and many others, may be of great service to the individual, but, in so far as they do not involve the principle of co-operation, they do not form part of the main purpose of the Classification. On the other hand, if a librarian adopt the Classification in a printed catalogue of his library, or for a published special

bibliography, he makes his catalogue a contribution to a complete subject catalogue of books, or his bibliography to an universal index of publications. These are part of the main object of the Classification.

Criticisms of the Classification divide themselves naturally into two classes of statement : (1) that a standard classification is not needed, or (2) that the Classification is unsuitable. A good many years ago a book was published by Dr. Karl Diesch, *Katalogsprobleme und Dezimalklassifikation*, Leipzig, 1927, in which he gathered together some seventy arguments against a scheme, which was intensely repugnant to him. As the statements made are at variance with fact, it seems necessary that they should be refuted. We take these statements in order and set against them, one by one, some of the relevant facts.

Dr. Diesch's criticisms are as follows :

1. *The Dewey System was devised for American libraries. Dewey had no knowledge of the system in use in countries abroad.*

Dr. Diesch knows that the Classification was developed for international use at Brussels. It is used in European libraries large and small and has been adopted recently by Dr. Diesch's own Government.

2. *What use of the system has been made in 50 years ?*

A list of users is published by the British Society for International Bibliography. Some three hundred thousand references are classified by the Decimal System every year.

3. *The many adherents of the system are confined to small undertakings. Practically it is not used by the large libraries. They have not the slightest reason and never will have to hand over their subject catalogues to an aimless equalisation and replace organic good by inorganic evil.*

The large Library of Congress prints the Dewey Classification numbers on its published catalogue cards. The Belgian National Library uses the U.D.C.

4. *Our fight is not against the system itself, but against the attempt to foist an impracticable system on libraries as a standard.*

Its use is not imperative in any library, unless it wishes to

make its publications a contribution to a general index to literature.

5. *The unification of subject cataloguing in all libraries of the cultured world on the Decimal System is impossible.*

Yes. There are always some people who prefer to have their own system.

6. *What would be the use of such unification. Its value is over-estimated.*

The Classification is the simplest means of producing a universal subject index.

7. *From the standpoint of the use of a library the author catalogue is the more important.*

No! For the serious student, the subject index may be the more important.

8. *Ninety per cent. of users do not want to know what literature on a given subject is available, but only to find a book known by its name and title.*

But, are mere numbers the criterion of importance?

9. *The majority of the public obtains information about books from bibliographical sources and from the library subject catalogues.*

Yes! But these need to be classified.

10. *The subject catalogue is retained only for its use to the specialist and for internal use to show how a subject is represented and what gaps remain to be filled.*

Is the specialist of less importance than the general public?

11. *But the alphabetical catchword index to the subject catalogue serves to facilitate its use and it is a question whether the catchword index might not replace it.*

The suggestion to use the alphabetical index alone ignores the difficulties of alphabetical arrangement, which brings unlike things together and separates like things. A system that may express the same idea in an almost unlimited number of ways in every language forms an effective barrier to collaboration.

12. *The idea is ever gaining ground and the question of even finer structure of the subject catalogue must undergo another serious test.*

13. *We can never dispense with a subject catalogue. And it can only fulfil its purpose completely in combination with an alphabetical index.*

This is quite true. The author realises that the subject catalogue has come to stay.

14. *The Decimal System has an alphabetical index. But an index which carefully shows all the errors and verbosity of a work does not improve it.*

This is verbosity indeed.

15. *The Decimal System is neither practical nor logical. It is so illogical that without an alphabetical index, books are practically unfindable. The Decimal System has been given to the librarian to hide his books.*

But the author has told us that the Decimal Classification has an index. And the books can be found easily by any sensible person.

16. *Granted that complete unification is undesirable. How far should it be carried out? Is there a point at which it is more trouble than use? More time may be spent in working out all possible methods of rationalisation than is saved by their use.*

We do not grant that unification is undesirable and we have already worked out our system.

17. *Effort at rationalisation must stop at a point, which each library considers right for its catalogue. A cataloguing system cannot be imposed upon a library from without but must grow of itself, being adapted to circumstances and needs. A special Art Library will refuse to place the biographies of artists in the biographical section of History as ordained by the Decimal Classification. A system must be adopted by a library because it is considered suitable.*

A special Art Library should catalogue its biographies, like any other special library, *i.e.* under the number for its Subject (in this case 7) coloned to that for Biography, 92, *e.g.* under 7:92.

18. *The Decimal System allows no modification, because that would sacrifice uniformity.*

Exactly. No modification can be allowed in a system used as a standard for collaboration. For purely internal use, modification is permitted, but may be regretted.

19. *To attain uniformity, one must put up with logical horrors at every step. The only liberty allowed to the librarian is to dispense with unnecessary subdivision.*

Yet, in spite of these dreadful horrors, the system continues to spread.

20. *But this makes the tangle worse. One hundred historical books, which could be arranged in three reasonable groups, would be reduced by the Decimal Classification to completely system-lacking confusion.*

For the arrangement of books on shelves, unnecessary subdivision should be dispensed with.

21. *But what would be the saving in time and labour, if all cataloguing schemes were everywhere alike.*

What saving indeed! Saving in time to librarians in the useless re-cataloguing of every copy of the same book in every library and in the labour of production of a union subject catalogue of books.

22. *The user gives little thought to the system. He always asks the librarian where to find this and that literature.*

Quite true!

23. *If he really attempted to understand the system, he would find his way more easily in a natural system, than in the artificial Decimal System, at variance with all logic, the obscurity of which will deter him for ever at the outset.* 24. *When we have at last the complete Decimal System, a genius will discover the natural system, which will make catalogues approachable by all.*

The author implies that we have no natural system at present to adopt. His tangled rhetoric obscures the fact that a standard bibliographical classification must be a compromise between a philosophical classification of knowledge and a practical code for the marking of information so that it can be filed for quick reference.

25. *A uniform system employed in all libraries would be no*

assistance to the librarian. *Every librarian lives in the system carried on in his library.*

Yet it would save librarians the trouble of cataloguing all their ordinary books.

26. *It would go against the grain to classify the Alsfelder passion play in Five Acts, under Entertainments, Theatre, Serious drama, instead of with the German literature of the Middle Ages.*

Then why not put it with German literature of the Middle Ages?

27. *The adoption of a uniform system will only save time and labour if all the mental work is done by the Central Office.*

Equally it would save time and labour, if the work were distributed among many agencies employing a standard classification.

28. *The dilettantism of the founder of the I.I.B. is shown by the fact that he seriously regarded it as possible to classify every book and every article in scientific periodicals and send out the printed titles provided with the Decimal numbers. Probably to-day this would require 1,000,000 titles.*

Such an output is not impossible. In Science alone we are producing annually three-quarters of a million printed bibliographical titles now.

29. *How much of the cost of the machinery necessary for this would be compensated for by the slightly decreased weariness of thinking of the place in which to find a book.*

The answer is that there may be no extra cost at all.

30. *What would be the use of so complete a bibliography? No one would use it, because the mass of valueless publications would swamp the valuable.*

The user would need to search only a few hundred entries instead of a mass of unclassified literature and would know that he had most of the available information about his subject.

31. *Meanwhile nothing further has been heard of the Brussels World Bibliography, or of the idea of leaving the scientific library work to be carried out from a central place, so that the insertion of the*

title in the library catalogue can be left finally to the care of an intelligent errand boy.

Evidently the author has been "living in the system carried on in his library." Before the war 120,000 classified references were being filed annually in the Science Library alone by unskilled girls, with a total of about 3,000,000 entries.

32. *But, if the classification is left to each single librarian, there can be no more talk of saving of time and labour or far-famed unification. The doubtful cases are far more numerous in the Decimal System than in any natural system, because in the artificial confusion, which is made completely impenetrable by the Brussels auxiliary tables, it is much more difficult to keep a true direction, than in a system in which natural logic can be used as a guide.*

A natural system does not exist.

33. *Tests reveal 20 per cent. of differences of opinion.* 34. *There are books easy to file. But how is one to file Töbelmann's Roman timbers.* 35. *Uniformity of classification will never be obtained. The classification of a book depends on the personal equation as well as the purpose of the library, e.g. a fire extinguishing apparatus from Luneborg would be regarded differently by a Low German historical association and a fire insurance company.*

There are places in the Classification for every such different aspect of a subject. Experts choose these places to suit their points of view and produce different entries. These different entries are an advantage.

36. *Although we are strictly only concerned with library catalogues, it is hardly possible quite to ignore the bibliographical use of the Decimal Classification.* 37. *A bibliography appeals to a far larger circle than the few courageous pioneers, who attempt to penetrate the subject catalogue. A certain uniformity has many advantages to people, who have not much time, or to whom self-gained knowledge is impossible.*

Bibliographical use is the main purpose of the classification. We have seen that uniformity of method is essential to the collaboration required in the production of a complete index.

38. *But here the Decimal System crumbles as soon as it is grasped. Scientific men of all faculties work with the Literarisches Zentralblatt.*

The best technological book review is that in Stahl und Eisen. The historian works with Dabelmann-Waitz, etc. Would anyone claim that these bibliographies would be better and more comprehensive if they were arranged on the Decimal System?

Yes. We do.

39. *A few unimportant articles in journals may be found in the ninth decimal place. But the best that has been said will be found in the fifth or sixth decimal places.*

This is entirely untrue. The number of decimal places depends partly on the relation of a subject to its main class and partly on the age of the subject.

40. *The only remaining ground for accepting the Decimal Classification is that it represents a kind of library Esperanto. A Russian book can be introduced into the catalogue without a knowledge of Russian. The Decimal Classification must be badly in need of justification, if the poor grounds of its independence of language have to be stressed.*

No. This is the main justification of the Decimal System : it allows the co-operation of bibliographers all over the world.

41. *It is not true that the number determines the idea more unequivocally than words, which bristle with several meanings. The word, not the complex number, is the expression of the idea. To think under the number, we must first turn this number into an idea, which we can do only through the medium of words.*

Certainly, the decimal number is merely a symbol. But it has a definite order and all references having that number are brought together, in proper relation to all other references classified decimally.

42. *To prove that the Decimal System is the worst possible system of cataloguing we must make sure what is to be demanded of a cataloguing system.* 43. *Dr. Hanauer has said we are seeking a means of filing and not a philosophical system.* 44. *Yes, and since the alphabet is not a logical system, it is used in the so-called catchword catalogue, which renounces all logic, and, in good subject catalogues, use is made of the alphabetical arrangement.*

Then what has been said about the logical horrors of the Decimal Classification falls to the ground. And we can realise the advantage of having only one place in the number

sequence of the Decimal System as compared with an almost unlimited number of possible places in the alphabetical chaos.

45. *It is true that some of the subject catalogue systems are antiquated. But when the Decimal System is a hundred years old, it will be too. Its nature is iron coercion and, when finally it will hold no longer, it will be scrapped as old iron.*

No! The Decimal System has an organisation for keeping it up to date.

46. *A system need not be logically founded, but it must fit without violence into the natural order of things.* 47. *The Decimal System is a completely artificial arrangement, neither logical, alphabetical nor chronological, but a tangled confusion.*

These tangled words have no foundation in fact.

48. *The basic error of the Decimal System is that it has not grown from within, but has entered from the outside.*

This is not true. The System has grown with the needs of its users.

49. *It has a second fault, it is concerned with the principle of subdivision to infinity and with the auxiliary tables. If these principles are possible for the natural sciences and technology, they are impossible for the mental sciences, which must have a linear arrangement founded on a generally holding, logically based sequence, e.g. grammar, oral teaching and reading, or a graphical, chronological or alphabetical sequence, whichever is best suited to the subject.* 50. *If these things are put into a Decimal System, the result is a terrific confusion and a misarrangement running counter to natural experience, which reaches a climax in the philological and historical sciences and has led to the system being renounced with silent contempt, or sometimes with vociferous anger.*

Any part of the Classification which is actually unsuitable can be modified as the requirements of use demand.

51. *The natural sciences and technology have been most carefully worked out, since, by their nature, they offer the least resistance to the principle of infinite subdivision. Nevertheless even the most fundamental divisions must cause much headshaking. Why should Building Construction be separated entirely from Engineering, although Mining*

is included. This must lead to annoying separations. Typewriters and Stenography are brought into Commerce, as though their nature lay only in their application to commercial activity.

This praise is appreciated. If there were any great disadvantage in the position of Building, the place would have been altered, as has the position of Typewriters.

52. *The adherent of the Decimal System runs riot in a splitting of ideas, which leads finally, even without the auxiliary tables, to complete atomising of a notion. The use of the ninth decimal place is not uncommon. With such subdivision each book must constitute its own class.*

The ninth decimal places are the result of practical need for subdivision.

53. *Therefore, in practice, this overdone subdivision is not employed. The more the system is subdivided, the more does it lose its practical utility.*

Yet, as has been said, the utility of the system is demonstrated by its increasing use.

54. *The incongruities, which are based on the combination of the decimal numbers, lead to forced association or to equally forced separation.*

This is true of alphabetical arrangement and quite untrue of the Decimal Classification.

55. *Confectionery is put in the third decimal place, while Steam turbines can only appear with six figures.*

That is because Steam turbines are so much younger than Sweets.

56. *How is it possible that the idea of the Decimal Classification could be considered at all by libraries? The only explanation is that there are natural as well as mental sciences.*

The classification is considered because it is good and because it is needed. The comparative lack of use in the "Humanities" is because workers in those fields have not wanted comprehensive bibliographies so much.

57. *For the natural sciences, the Decimal System is not a gain,*

but it can be used. For the mental sciences the system is plainly unusable.

This is, of course, quite untrue.

58. *Even if the Decimal System were good as a cataloguing system, exception must be taken to the difficult number complexes used to denote the rubrics.*

Practical tests prove that numbers are quicker to arrange than letters.

59. *The headings of German subject catalogues consist of a letter complex in combination with a number, e.g. Bf38. If only two letters are employed, the use of a third Greek letter is possible. This gives $24 \times 24 \times 24$, or 600 sections. More sections can be obtained by using abbreviated words for main sections and then starting the letter-number complexes. In this way short symbols can be elaborated, which will be sufficient for the largest library.*

Dr. Diesch's arithmetic is no better than his logic. 24^3 is nearly 14,000 not 600, and his suggestion that letters would give shorter symbols than numbers is not true, unless many letters of the alphabet are used in each stage of subdivision. In practice the average number of subdivisions required at each stage is less than nine, and letters have no advantage over figures.

60. *Mixed complexes are easier to remember than the purely numerical series. A complete mental training is required to use the multifigure numbers of the Decimal System.*

This is exactly the reverse of the truth.

61. *But, if we consider the American tables confused and not clear, they are transparent as compared with the magic covering, which the system of auxiliary tables throws over the system.* 62. *Such an expression as*

$$526.9:351.714.2(431)''1927''(07) = 3,$$

Guide to General Prussian cadastral measurement in 1927, is not classification but idle joking.

This number is meant only to show the extreme versatility of the system. So many terms would not be joined in practice. There were objections to the rules for the use of the auxiliary tables, but these objections have been removed.

63. *The expression of reigns and dynasties, by means of years in inverted commas is also confusing, e.g. "1789·07·14" for the Storming of the Bastille.*

The number quoted might suggest the event, even to one who had not heard of the Classification.

64. *The activity of the I.I.B. is an example of over-organisation. A gigantic amount of work is put into the ever more detailed structure of the Classification. In the effort to produce a saving of labour, a waste of effort is incurred, which is tragic. What good could not have been done, if the work had been put to productive purposes?*

Could the Author suggest how to compile a classified index of three million entries like that in the Science Library with less labour?

65. *The verdict on the bewitched multiplication table of the Decimal System could run shortly and concisely "throw the atrocity to the dogs."*

This is merely wishful thinking.

66. *The claim that Technology needs the Decimal System can be quickly refuted by the fact, that very notable technical circles wish to know nothing about the Decimal Classification.*

It is proper to leave bibliography to the bibliographers.

67. *The technical-librarian world is united on the point that the Brussels Institute is an entirely superfluous foundation. The gigantic index remains unused and the organisation, which should only be a means to an end, has become an end in itself.*

The utility of the Brussels Institute, which has now become the International Federation for Documentation, and its headquarters transferred to The Hague, has been recognised internationally. The lack of staff of the former Institute and not least its totally inadequate library have greatly hampered its work as a centre of information. That work goes on elsewhere, e.g. at the Dutch Institute of Documentation, the Science Library and the new German Documentation Society.

68. *The idea that the Berlin Title press and the Leipzig Book index should add its decimal number to every book (in how many cases would the number come out differently) would mean a doubling of the staff at each of these places. If one has now sometimes to wait six*

weeks for a Berlin title, with the burden of the Decimal Classification, probably a waiting time of three months would not be exceptional.

Even with a double staff? On the contrary, it is conceivable that an actual saving of time in compilation might result.

69. *To introduce the Decimal Classification would mean an increase of staff and this under the banner of saving.*

The contrary would be the case. The purpose of the Decimal Classification is to achieve a comprehensive index to recorded information by the co-operation of bibliographical workers. Saving of labour in production is not the primary aim, although this may be incidental, because a number is generally shorter to write than a verbal description of a subject. And when a paper has been classified by its decimal number, the index entry of that paper has been made also, whether it be the entry in the index to the volume containing the paper, in the index to a series of volumes, or in the Universal Index.

70. *The adoption of the Decimal System would be the surest way of disorganising our libraries.*

And yet the Swiss Government has used the Classification to organise the co-operation of the Swiss State libraries.

And so with this piece of unfounded invective the author's attack is exhausted. It will be seen that any one of these strictures might have been made the text of a sermon on bibliography. We have confined ourselves to the shortest possible comments, not for want of argument, but to keep within bounds the length of a long chapter. Full answers to all criticisms have been made at different times in the literature of the subject. The purpose of this chapter is to show that every criticism has its answer.

Let us conclude this concise recital of the history and technique of documentation with a quotation, which seems to express the true essence of the art :

Order is nature's beauty, and the way
To order is by rules that art hath found.

GWILLIM.