WOODCROFT’S HERITAGE: THE COLLECTIONS AT THE SCIENCE REFERENCE LIBRARY

R. M. S. HALL

Any considerable library has a character all its own, a character usually reflecting the disproportionate influence of a few outstanding men who have shaped its development. The Science Reference Library, which celebrated its 125th anniversary on 5 March 1980, is no exception for, *primum inter pares*, it is the library of Bennet Woodcroft.

Woodcroft was an extraordinary man even by the standards of the mid-Victorians. A Fellow of the Royal Society, he had been a manufacturer, a patentee, and Professor of Machinery at University College, London, before joining the Patent Office in 1852. He then stage-managed the evolution of the Patent Office into its modern form, established the published series of British patents, collected and encouraged others to collect historic technological material which helped to form the nucleus of the Science Museum, was responsible for the deposit of sets of British patent specifications in regional libraries, and built, equipped, and was the first librarian of the Patent Office Library.

Most if not all of his later public life stemmed from a central belief that the record of invention was an invaluable source of technical information. He was a tireless advocate of the free and immediate availability of this technical information to all who could use it. From a library point of view, one prime result has been the jealously maintained principle that the collections shall be on open access, and Taylor’s architecturally delightful reading room of 1902 at Southampton Buildings naturally embodied this principle, established at the outset in the original library of 1855–7.

The 1902 room still serves the S.R.L., though the immediate basement has since been annexed to provide an additional reading area. Unremitting pressure on library space from the influx of new material published each year—some 750,000 items a year in the patent area alone—has resulted in S.R.L. possessing four reading rooms in separate, and regrettably far from adjacent, buildings.

The original remit, incorporated in the 1853 memorial to the Commissioners of Patents following the Prince Consort’s suggestion of a library, is a clear progenitor of the present one. Thus the memorial asked that steps should be taken ‘for the erection and maintenance of a central commodious Patent Office worthy of the country, where ready access may be had to a Library, Reading Room and Museum furnished with papers, books and models indispensable to the right direction and advance of British Industry’. It is a matter of
conjecture how far the example of the U.S. Patent Office Library had leavened this enterprise.

The Patent Office Library had already amalgamated with the library departments of the British Museum, becoming the National Reference Library of Science and Invention, before the British Library Act of 1973. The combined libraries then became the Reference Division of the British Library and the S.R.L. assumed its present name. The merger with the British Museum departments led to various transfers from them to the S.R.L. of works in the life and descriptive sciences which, since these dealt with unpatentable matters, the Patent Office Library had not collected extensively. It also led to the appearance in S.R.L. of publications acquired by copyright deposit. The transfers, initially to a holding store in Bayswater, were the first stage towards a unified stock at a single site, and some works even now bear the marking ‘South Bank’. The long haul to a unified building is a saga in itself; suffice it here to say that a single site for S.R.L. is still a matter of the future.

As a direct result of this history, the strength of the reference collections resides in their unique comprehensiveness rather than in any concentration on the possession of a few top-drawer items, though, thanks largely to Woodcroft, these do find their place in the collections. ¹ On the one hand, the Science Reference Library takes some 3,000 periodicals dealing with the modern chemical and energy industries, and on the other the library’s holdings include a copy of Carnot’s Réflexions sur la puissance Motrice du Feu published in Paris in 1824. This founding work in thermodynamics, the science whose principles underlie all the engines which power both industry and transport, was already rare when Lord Kelvin tried to locate a copy. Other seminal works of the modern world include the first edition of J.-B. J. Fourier, Théorie Analytique de la Chaleur (Paris, 1822) (fig. 1), for mathematical analysis of wave transmission, commonly known as Fourier analysis, is a necessary step in activities ranging from the design of radar systems or the development of better loudspeakers for musical reproduction to the improvement of motor car suspension systems, astronomy, and the achievement of space travel.

Space travel, for so long a dream, has become an everyday reality in the past two decades. The records of the more spectacular aspects of space travel have now found their place in the collections as monographs,² reports, and articles in scientific periodicals. Interplanetary space travel is now confined, however, to a few deep-space probes and attention has turned once again to earth satellites. Meteorological and land-use satellites are the current vehicles for large-scale aerial photography and here the collections contain a record of the development of photography of the earth’s surface from the air above. In the middle 1800s, Nadar, the pseudonymous popular Parisian photographer of the time, sought ways of aerial photography for his plans to survey France from the air and reduce the labour of ground survey. On 23 October 1858, as Gaspard Felix Tournachon, he patented a means of aerial photography from balloons. In the 1850s photography was not to be lightly undertaken, and Tournachon’s description of his invention includes not just apparatus for vertical photography but also, with no photographic films available ‘off the shelf’, methods for coating plates with collodion, sensitizing them, and developing the image after the exposure, all while suspended in the balloon gondola.
As is often the case, announcement preceded practicality and some years, indeed almost a decade, elapsed before balloons could be stabilized sufficiently for routine success with such photographs. Developments in aerial photography techniques were accelerated by military requirements—not least in two World Wars—and much of the subsequent history is military in nature, a field which S.R.L. does not cover. The advent of satellites, however, military though many are, has also brought peaceable developments primarily in meteorology and earth-resource recording. S.R.L. as part of its geological collections maintains lists of earth imagery available from the LANDSAT satellite programmes (fig. 2). The terminology of ‘imagery’ and the pattern of the holdings are both consequences of the nature of the surveying instruments in the satellites. Though these satellites include relatively conventional cameras, they also contain scanners using video-type techniques whose results appear as electronic digital signals and therefore ‘images’ is a more appropriate description than ‘photographs’. The amount of data recorded from these satellites is so huge that images of particular areas are produced on demand by processing the signals kept in special data centres, and therefore S.R.L.’s satellite image holdings are
Fig. 2. The Lake District shown from 600 miles up. A LANDSAT satellite picture processed from digital telemetry beamed to earth. The standard scale is 1:1,000,000. (By permission of Royal Aircraft Establishment, Farnborough)
not of the basic image data but of the indexes to these images so that the correct items can be obtained by interested users.

In this we can see a parallel to the situation with scientific journals, save that here S.R.L. is also its own data bank. Some 1,000 different abstracting and indexing journals are taken by S.R.L. in the Holborn reading rooms, and whereas the 25,000 periodicals at Holborn alone have long since outgrown the storage capacity of the 1922 reading room even with its lower ground floor extension—there are comparable numbers at Bayswater dealing with the life and earth sciences—the abstracting journals are maintained at Holborn back to the start of publication of each journal. The periodicals which the abstracting journals refer to are available to readers on open access from the issues for 1960 onwards. The pre-1960 issues are in the Kean Street Annex reading room, some fifteen minutes’ walk away, with certain older material in reserve store.

The commencement of the Holborn-based abstracting journals predates the present reading rooms, for instance Science Abstracts commenced publication in January 1898. Reading through the subjects covered in that first volume gives a certain sense of *déjà vu* with, for instance, a description of an electrical generating station run from tidal power in the Côtes-du-Nord. Even the very first abstract deals with problems of crystallization, a subject of perennial scientific interest then and now.

Science Abstracts—which dealt with ‘Physics and Electrical Engineering’ and was issued jointly by the Institution of Electrical Engineers (I.E.E.) and the Physical Society of London—was international in scope and coverage from the outset, a tradition maintained by Science Abstracts today still under the aegis of the I.E.E. through the INSPEC organization. This international scope is the norm for abstracting journals dealing with scientific and technological publications and many of these journals include patents. However, the abstract or abridgment publications dealing purely with patents are nearly all national in scope since they are issued by each country’s patent office with notable exceptions such as the Derwent series which treat patents by subject content rather than country of origin, and which are published from offices roughly midway between the Bloomsbury and Holborn reading rooms of the Reference Division.

Abridgments of patents, like the published series of specifications themselves, are a legacy of Woodcroft’s and it is to him that we owe the fact that the printed U.K. patent specifications commence earlier than those of any other country. The date 1617 is in point of fact arbitrary for earlier patents exist; but it is sufficient to establish the antiquity of grants of monopoly by the State in return for disclosure of the details of the invention (fig. 3). Once Woodcroft and the Office started, it took but six years for the old, previously unpublished, specifications to be printed with their drawings. From 1858 onwards the Office had only the current series to produce.

By exchange and by purchase the S.R.L. obtains the specifications of all the major and virtually all the minor patent-issuing countries; and the total stocks exceed nineteen million specifications. International agreements are now resulting in patents such as those from the European Patent Office which are accepted as national patents, if the inventor so wishes and pays, in the various European countries taking part. This type of arrangement
Engraving and Printing Maps, Plans, &c.

RATHBURN & BURGES' PATENT.

JAMES, by the grace of God King of England, Scotland, France, and Ireland, Defender of the Faith, &c., to all justices of peace, mayors, sheriffs, bailiffs, constables, and all officers, ministers, and subjects of us, our heirs and successors, to whom it shall or may appertaine, and to every of them, greeting.

WHEREAS we are informed that amongst foreign nations there are faire, curious, and artificial descripions, plott, and mappes made and set forth of their principall citiies and townes of greatest note, which being exactlie drawne out in mettall and printed of, are dispersed and sent abroad into all partes, to the greate honor and renowne of those princes in whose dominions they are, and that of our citie of London, being the chief and principall in this our kindome of England, there hath never been made or taken any true or piecet descripicion, but false and meane draught, cutt out in wood, and soe dispersed abroade, to the greate disparagement and disgrace of soe famous and worthie a state: And whereas our lovinge subjecte, Aron Rathborne, Gentleman, practicioner in the mathematices, hath a greate desire to take a piecet surveale as well of the said citie of London as of divers others places within this our kindome of England heretofore mentioned, and to make suche exacte plott, mappes, and descripions thereof as hath not been hitherto performed by anie, and hath humble besought us that wee would bee graciously pleased to graunte vnto him our Royall lycence and privileege, (the wante whereof, as

Fig. 3: Woodcroft organized the printing of over 14,000 pre-1852 patents: this is the first in the sequence
should in due course reduce the number of patent documents issued around the world. Perhaps inevitably, the initial result has been an increase in the number of documents which patents libraries must accommodate and make available. Nevertheless, Woodcroft's view of patents as an information source is now in resurgence after many years when the emphasis has been on their use as documents defining monopolies.

The range of inventions which can be patented varies from country to country, most of the variations between countries being largely a matter of degree. However, there are some major exceptions, one such being the United States plant patents. Since they are a patent series, the S.R.L. includes them amongst its patent collections, but they also have value in showing how the depth of the S.R.L. collections can be used to illuminate such aspects as the recording of the physical shapes and colours of objects both natural and man-made. The plant patents, covering ‘... any distinct and new variety of plant, including cultivated sports, mutants, hybrids and newly-found seedlings ...' commenced in numerical sequence from 18 August 1931, and are generally illustrated by colour photographs, reproduced as halftones. A different approach has been adopted in Curtis's *Botanical Magazine*, a publication devoted to illustrated descriptions of plants. This was one of the life-science periodicals which did form part of the Patent Office Library stock and the holdings extend back to volume i of 1787, the first part containing three plates and costing, then, one shilling (fig. 4). From that beginning in February 1787 until February 1948, all the plates were hand-coloured except for a few chromolithographic plates in volume cxvii, due out in 1921 but seriously delayed in production by the change in ownership in that year. The issues in the remainder of 1948 were in four-colour halftone and then the process was changed to four-colour gravure with results approximating to hand-colouring.

Illustrations of mechanical devices represented in the S.R.L. collections have ranged from woodcuts through engraving and lithography to photographic processes of varying kinds, of which latter it may be confidently hazarded that the majority of reproductions are by halftones or photo-offset with only a comparative few produced by photogravure.

The plethora of drawings of mechanical items in the collections is such that to single out any particular drawing could only be from personal choice. Any admirer of mechanical devices, of steam locomotives, racing cars, or aeroplanes will have his own favourite drawing represented somewhere in the stocks of periodicals such as *The Engineer, Engineering, Flight, The Aeroplane, Motor* and *The Autocar*, though these titles are only a few of the better-known ones. At one time it was *de rigueur* to publish in the technical press drawings of any new engine, ship, or piece of industrial plant but regrettably this practice has declined in recent years, save only the drawings included in patents—but these naturally enough are usually detail drawings. The drawings in U.S. patent specifications continue to be more comprehensive in general than those in other countries' publications. Three-view general arrangement drawings have been the convention for industrial plant and rail transport but are comparatively rare for aircraft (fig. 5) and rare for road transport, the latter two categories employing techniques such as isometric cut-away drawings or perspective views, often the result of airbrush work on photographs.
Fig. 4. Iris persica. The first plate in The Botanical Magazine: or, Flower-Garden Displayed. (London, for W. Curtis, 1787)
Fig. 5. Drawings from the 1904 British Patent for the Wright brothers' aeroplane
Colour reproductions have been few until the recent spread of colour halftones in technical works and here the use of colour has often been more intensive in the advertising matter in trade publications than in the editorial sections. Since trade publications are as a class in any case poorly indexed, the availability of extensive runs of such publications on open access for quick consultation of many items is a necessity for their effective use. The trade literature collections,\(^3\) that is of manufacturers’ pamphlets and catalogues, show similar trends in illustration, and products are often depicted in this literature which are not to be found in any other published form, even in patent publications.

Library collections dealing with modern science are inevitably changing in physical form,\(^4\) and the indications are that this change may accelerate. The first considerable change in physical form from conventional books resulted from large governmental expenditure, world-wide on science and technology, in the years following 1945. The reports of this work were so numerous and voluminous, especially in the U.S.A., that it became clear that conventional printing even with the palliative of reproduction of typescript originals, could no longer cope with the number of reports and the wide distribution necessary for the effective use of the information. The first attempt at a solution, which was to prove a strictly temporary one, was to use microcards which are photographic prints on a greatly reduced scale of the original typescript. Examples of these microcards are in the S.R.L. collections but are greatly overshadowed in number by their much more successful and still current successors. These are also photographic reproductions on reduced scales, but as transparencies, and are known as microfiche. The most common form is a 6\(^{\prime\prime}\) × 4\(^{\prime\prime}\) sheet of film, with individual pages reproduced at either 24 \times or 42 \times reduction in size. Special viewing machines have to be used to consult the fiche, but as soon as any considerable stock is amassed—and the S.R.L. stock of report microfiche exceeds 1.5 million, being only a selective holding of those available—then the space savings become very considerable since one 6\(^{\prime\prime}\) × 4\(^{\prime\prime}\) sheet of film contains the equivalent of a report some quarter to half inch thick of A4 page size. Microfiche are now being produced directly from computer databases by special machinery without the intermediate printed step occurring at all. The catalogue of the S.R.L. is one such production and all items added to the stock since late 1975 are now listed in microfiche and not on catalogue cards. Not the least advantage to a library with multiple reading rooms is the ease whereby microfiche catalogues can be replicated in the various rooms. The machines used to produce fiche, called COM for short (originally this stood for Computer Output on Microfilm), are special versions of computer typesetters.

Computer typesetting is now commonplace in the publishing industry but printed works produced from computer databases are still comparatively rare and confined largely to abstracting and indexing journals. Although economics have been the usual underlying reason for the adoption of computer typesetting, there are some publications in the S.R.L. collections which would be difficult or impossible to produce by any other method. One of these, and certainly the largest in physical bulk, is the Science Citation Index. The basis of this index is, that since scientific publications refer to, that is cite, other relevant work, the S.C.I. is a complete cross-reference index of all citations occurring in a
broad spectrum of journals which are not limited to any one subject-field as in conventional abstracting journals. The opportunities offered by this method of indexing complement the subject approach which is the main raison d'être of abstracting journals.

As illustration, let us take the research by Watson and Crick on D.N.A. Following up this work from the original 1953 paper in Nature will be easy using abstracting journals provided the interest is in D.N.A. or in publications by these authors. But an abstracting journal will not be an easy way of quickly following up, for instance, the use of the same techniques by other investigators on different molecules of interest to geneticists. Citation indexes, on the other hand, will immediately show who has cited the work by Watson and Crick, and authors identified in this way will include those using the techniques on different molecules. Problems as diverse as the development of scientific research and the diffusion of information through scientific periodicals have yielded to citation analysis. Remembering that Watson and Crick won the Nobel Prize, the strength of citations has been shown to be a good predictor of scientific Nobel laureates: another aspect of the Social Science of Science.

In one sense, publications produced from computer databases contain the seeds of their own destruction. Most abstracting journals which use databases for typesetting their printed versions are also available on-line from computer information systems. The S.R.L. was one of the first libraries to offer public access to these computer systems and has specialist staff dealing with some fifty different publications available in this way. Consultations of these systems by library users is increasing very rapidly and this use could be the harbinger of general availability and acceptance of the electronic journal, where the information is held in electronic form at computer centres and is read using modified television sets, never appearing in conventional printed form.

Few, save the enthusiasts for change, are yet prepared to commit themselves on the rate or scale of change we may expect, but the consensus is clear that we will find an increase in scientific information available through electronic form. Whether that increase is an alternative or an addition to conventional library consultation, it will be reflected in S.R.L.'s services to its users throughout the country.

Though technology would now enable Nevil Shute's engineer to be home for tea in Aberdeen or Paris, the aims of the Library remain those that Woodcroft set out to achieve a century and a quarter ago. Let us hope future authors will find it possible to be equally complimentary.

He will come out presently and take a bus to Chancery Lane, to spend the remainder of the day in the Library of the Patent Office. He will be home at Somerset Road, Ealing, in time for tea. He will spend the evening in the workshop, working on the current model.

He has achieved the type of life that he desires; he wants no other. He is perfectly, supremely happy.
1 By Act of Parliament in 1853 Woodcroft's collection of books and his *Index of Patentees of Inventions* from the time of James I were taken into the Office stock. The *Index* was published in 1854, the chronological list alone running to over 1,500 pages.

2 An illustrative collection of satellite photographs can be found in the NASA publication (SP-360) by N. M. Short *et al.*, *Mission to Earth: LANDSAT views the world* (Washington, 1976), shelved at classmark CA 080 in the Bayswater collections. LANDSAT I was launched on 23 July 1972.

3 Housed at present in the Kean Street Annexe, though commercially produced microfilm systems are available at Southampton Buildings. The collections are shelved by company name with older and historic material in separate sequence.

4 Including some annexes to printed works in the form of gramophone records. Various patent specifications are now issued as 'aperture cards', where a microfilm of eight printed pages is inserted in the middle of a computer punched card. The punched codes in the card make it possible to select particular specifications of interest for automatic display.

5 The concluding paragraphs of Nevil Shute, *Trustee from the Toolroom* (London, 1960); quoted by kind permission of A. P. Watt Ltd. Nevil Shute Norway (who used the pen-name Nevil Shute) was himself no mean engineer.