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# Mass deacidification: The Wei T'o understanding

By Richard D. Smith

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*Deterioration of research materials in U.S. libraries is more expensive to ignore than fix.*

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**T**his article will focus on how research libraries can apply mass deacidification to solve the challenge of book deterioration. Libraries need to examine the ideas underlying mass preservation, consider how these ideas were reached, what mass deacidification will and will not do, and the relationship of mass deacidification to mass preservation. These ideas and their implications will be considered by reporting on the condition of library collections, deacidification's ability to meet library needs, deacidification programs in national libraries, the status of mass deacidification in North America, funding mass deacidification programs, and choice among mass deacidification systems.

Additional information may be found in "Pres-

ervation: The Wei T'o Way," *C&RL News*, December 1984, and the follow-up articles appearing in the January and March 1985 issues; in Ron Chesniuk's interview, "On Assignment: Preservation: The Wei T'o Way," *Wilson Library Bulletin* (June 1986); and in "Answers to Frequent Questions Regarding the Wei T'o Nonaqueous Book Deacidification System," available from Wei T'o® Associates.<sup>1</sup>

## **The condition of library collections**

All librarians know that the condition of books in research library collections is extremely poor. The paper in over 40% of the books in some libraries is so brittle that the books cannot be circulated.<sup>2</sup> Consider what that statement implies. The purpose of libraries is to ensure that books are available for ev-

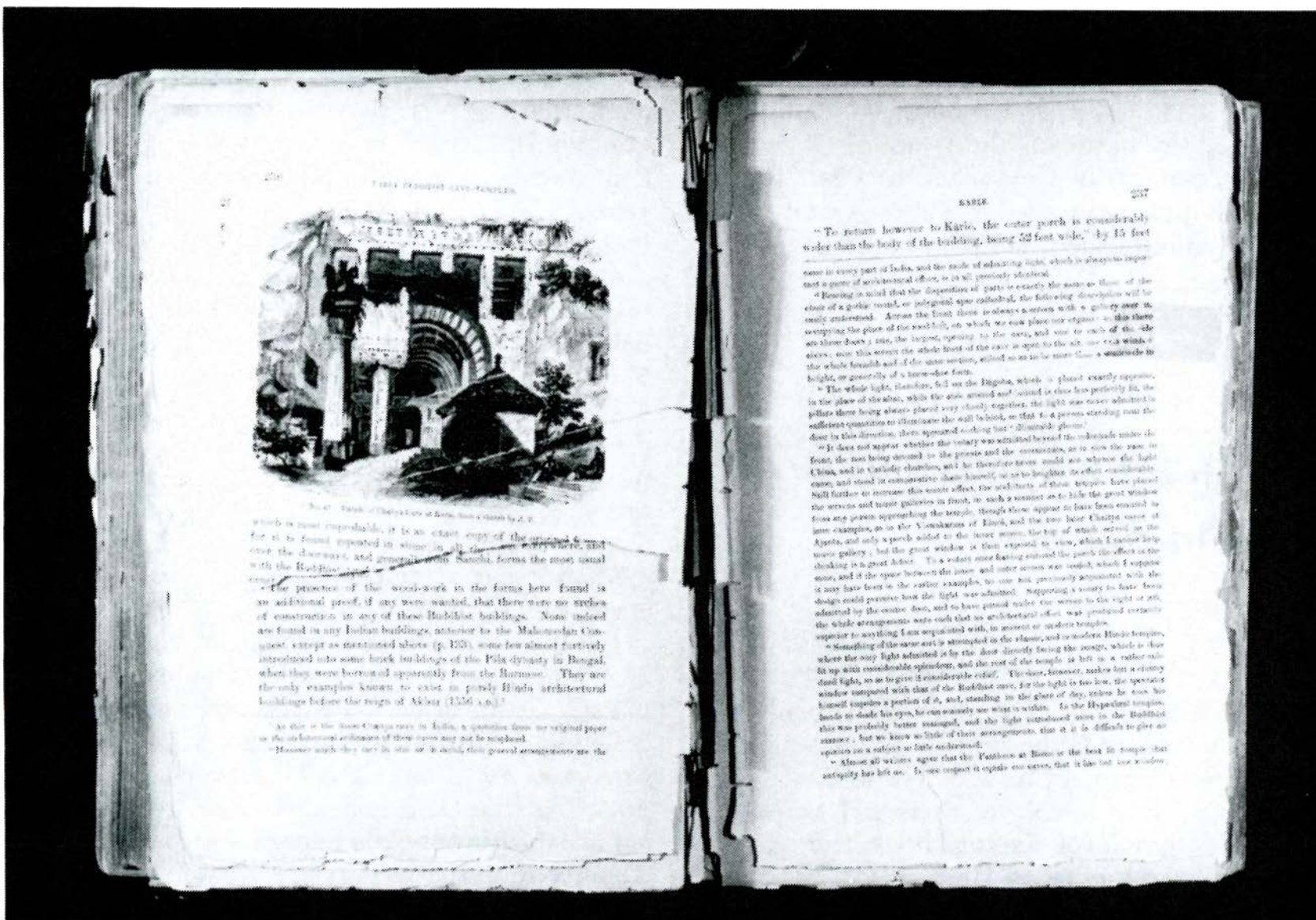
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\*An earlier version of this paper was presented at Session G-4, "Mass Deacidification: Methods and Feasibility," of the 79th Annual Meeting of American Association of Law Libraries, Sheraton Washington Hotel, Washington, D.C., July 8, 1986, and kindly released by the *Law Library Journal* for publication in *C&RL News* because of its general interest. The author is a lecturer in Conservation of Library Materials at the Graduate Library School of the University of Chicago, a registered professional engineer (State of Ohio), and a Fellow of the American Institute of Chemistry, the American Institute for Conservation, and the International Institute for Conservation.

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<sup>1</sup>Send a stamped, self-addressed envelope to Wei T'o Associates, Inc., P.O. Box 40, Matteson, IL 60443, for a free copy of "Answers to Frequent Questions Regarding the Wei T'o Nonaqueous Book Deacidification System."

<sup>2</sup>"Preservation: The Battle to Save the Nation's Libraries," *Research Libraries Group News* 11 (September 1986):4-6, 11-16; "New Ways Developed to Preserve Paper," *Chemical and Engineering News* 57 (October 1, 1979):37, 42-43.



*A not too extreme example of binding problems caused by acid paper.*

everyone who needs them; but 40% of the books in some libraries are so brittle that they cannot be used.

No one knows if America would have a civil war if censorship forced librarians to remove 40% of the books in their library collections, but there certainly would be civil unrest. There would be civil rights marches, political campaigns, legislation from Congress, Supreme Court rulings, new ALA divisions, dynamic library schools, and an elevation in their professional and social status that librarians can only dimly imagine. But, with censorship imposed by chemical attack, rather than by one group imposing its will upon another, librarians make hardly a squeak—when they should be screaming that a national scandal exists.

American research library collections contain 300,000,000 books, and almost half of the books in some of these libraries cannot be used. The lowest estimates of brittle books in research library collections average about 9%, the highest estimates average almost 50%. At an overall average of 30%, 90 million books standing on the shelves of American research libraries cannot be used because their leaves have become too brittle as a result of acid attack.

Why do librarians allow this situation to exist? Is it because papermakers deliberately made “bad” paper during the 19th century? We know this is not true. If papermakers had not begun to use alumrosin sizing and manufacture chemical woodpulp paper, practically no libraries would exist today.

During the 19th century paper changed from an unusual luxury to a very common commodity. There were no alternatives for papermakers to choose. This revolution in papermaking that librarians complain about is one of the 19th-century advances that enabled our society to flourish and led to all the benefits enjoyed today.

For most readers, the real problem with paper is not its impermanence, but rather the fact that paper lasts too long. Newsprint, the least stable paper produced, is far too permanent for almost all newspaper buyers. The same holds true for books. For example, how many books in your personal library are too brittle to read, one or two out of 500 or 1,000? No other commodity exceeds your needs so well. Your clothes, your automobile, your home...all need maintenance and repair. Why should books on library shelves be expected to meet a standard that society asks no other commodity to meet just because librarians would like library books to last longer than ordinary books? The fact is, most books in libraries are not made for library use. They are, with the exception of some reference books, made for individual readers to purchase and use.<sup>3</sup> From this viewpoint, it is irrefutable that the

<sup>3</sup>The forward-looking efforts, led by research libraries, to have publishers print books on stable alkaline paper will, at best, only provide libraries with a partial solution to deteriorating collections and, at worst, offer only another excuse for librarians not taking action. Forty to sixty percent of the acquisitions of research libraries come either from

publishing and papermaking industries have served their customers magnificently.

Consequently, the questions librarians should ask are: 1) How well do the books which libraries buy serve the needs of library users? 2) If these books are not satisfactory, what steps can libraries take to improve the books? Almost twenty years ago, an unpublished, scientific study was con-

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## *Collection values are moving backwards at \$750 million per year.*

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ducted on the condition of paper in 231 books randomly selected from the General Collections of the Newberry Library in Chicago. The folding endurance of paper in twenty of these 231 books was compared to copies of identical books from the collections of the Lawrence University Library and The Research Libraries of the New York Public Library. The results of this tri-library comparison were published by *Restaurator* in 1972.<sup>4</sup>

This data was used to calculate the folding endurance half-lives of paper in these libraries. The half-lives, i.e., the time for the paper to lose half of its folding endurance, were and may still be approximately:

Lawrence University (17.6 years)

Newberry Library (16.8 years)

New York Public Library (12.8 years)

It was assumed that the shorter lifetime for NYPL books was caused by their far greater use and the ten times greater acidity of their paper caused by Lower Manhattan's air pollution. These estimates can be expected to stand up under scrutiny. Standard statistical and laboratory testing procedures were used in this comparison of three library collections.

Moreover, similar results can be obtained by ap-

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countries or from publishers for whom the use of permanent papers is a distant dream. Moreover, either depression or war-time conditions will force publishers to produce most, if not all, books on impermanent papers. An alternate, more effective solution, which lies within the grasp of librarians, is for libraries to continue to acquire the books they need and to convert, through deacidification, the acidic, unstable papers they receive to permanent alkaline papers.

<sup>4</sup>Richard D. Smith, "A Comparison of Paper in Identical Copies of Books from the Lawrence University, the Newberry, and the New York Public Libraries," *Restaurator: International Journal for the Preservation of Library and Information Material*, suppl. no. 2 (1972), 84p.

plying the same statistical techniques to data produced by other independent researchers. The folding endurance half-life of the paper in the 500 books that the W.J. Barrow Research Laboratory examined in its landmark study has, using the identical statistical procedure, been computed as 17.2 years.<sup>5</sup> The 22-year-long use study of identical copies of the *Dictionary of American Biography* in libraries all over the United States and Canada determined that papers in the copies studied deteriorated similarly at an embrittlement rate of 57% in 15 years and 85% in 22 years.<sup>6</sup>

Based upon the above findings, an average half-life of 15 years is a reasonable assumption for the purpose of making estimates about the future condition of library collections. For convenience, an average folding endurance deterioration rate of 4.8% per year, which is identical to a half-life of 15 years, will be used.

Given an unstable acid annual deterioration rate of 4.8%, what benefit can libraries expect using mass deacidification to convert acid-deteriorating collections into alkaline-stable collections? The Preservation Office of The Library of Congress reports that the DEZ deacidification treatment increases the life of acidic paper three to five times.<sup>7</sup> An increase of two to four times was found in studies at the University of Chicago.<sup>8</sup> Using an average increase of four times, the rate of aging after deacidification drops to 1.2% per year, i.e., a half-life of 60 years. These acidic and deacidified annual aging rates can be used as depreciation or negative compound interest rates to compute their negative effect on library collection values.

If for computational convenience we say the Library of Congress holds 13,000,000 books, and each book has a replacement cost of \$100, the Library of Congress book collection has a cash value of \$1,300,000,000. At 4.8% per year, American taxpayers lost \$62,400,000 last year, \$172,000 each day on books alone, at the Library of Congress. America's research libraries hold over 300,000,000 books, twenty-three times as many as the Library of Congress; thus by extrapolation all the books lost to chemical deterioration last year cost major American libraries \$1,440,000,000 in book availability. This \$1.44 billion dollars is about four times the annual book budget (\$330 million in FY

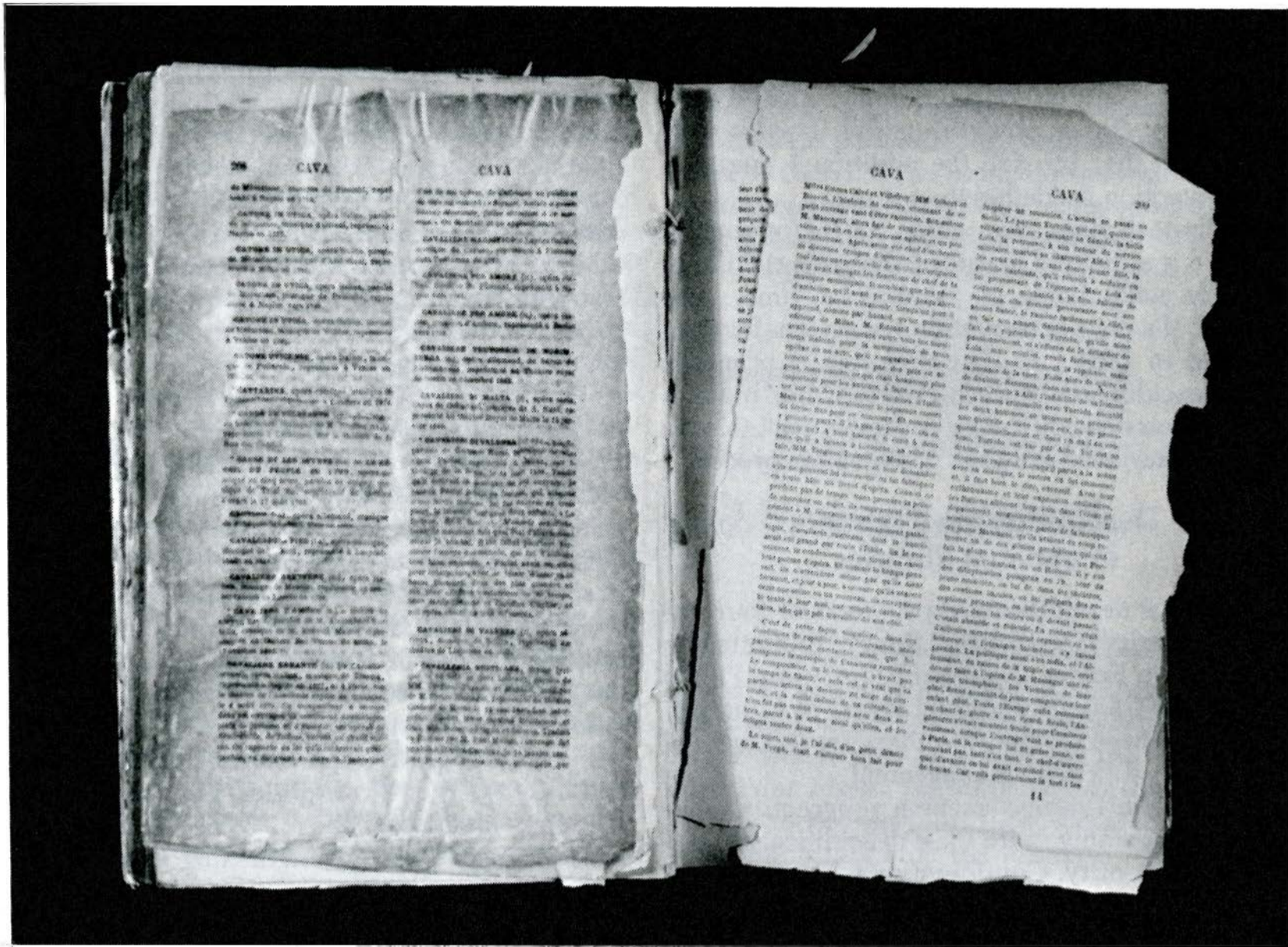
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<sup>5</sup>William J. Barrow Research Laboratory, *Permanence/Durability of the Book* (Richmond, Va.: The Laboratory, 1964), vol. 2, *Test Data of Naturally Aged Papers*.

<sup>6</sup>Harry F. Lewis, "The Deterioration of Book Paper in Library Use," *American Archivist* 22 (July 1959):309-22.

<sup>7</sup>Peter G. Sparks, "Mass Deacidification" (presentation to the Fall Technology Workshop, Library Binding Institute, at The Library of Congress, Washington, D.C., October 27, 1986).

<sup>8</sup>Richard D. Smith, "The Nonaqueous Deacidification of Paper and Books" (Ph.D. diss., University of Chicago, 1970).



Poor mending practices can intensify acid attack.

1984/85) of ARL libraries, and suggests that, allowing for acquisition costs, the value of American research library collections is moving backwards at about three-quarters of a billion dollars per year. Whether evaluated against a \$750 million negative capital flow each year or against an almost \$4 million loss every day ( $\$1,440,000,000 \div 365$ ) in book collections alone, the preservation efforts of research libraries, although very laudable, are barely scratching the surface of a gigantic problem. These efforts by dedicated preservation librarians hardly qualify as an incoherent hiccup in terms of the collection management attention that losses of this magnitude assert is needed.

If this assessment of past practice makes you uncomfortable, contrast the restraint of these comments to the headlines and outrage that follow the theft of a few hundred books from a major research library. Here, acid attack is "stealing" 40,000 ( $\$4,000,000 \div \$100/\text{book}$ ) books every day of the year!

The difference between the unstable acid aging rate of 4.8% and the deacidified aging rate of 1.2% can be used to establish the benefit from deacidification. The savings of 3.6% per year ( $\$3.60$  per book), that is,  $\$46,800,000$  ( $\$1.3 \text{ billion} \times 3.6\%$ ) when the entire LC collection is deacidified, puts the originally projected cost of  $\$11,500,000$  for the LC Mass Deacidification Facility into appropriate perspective. Any effective mass deacidification system, the LC DEZ System at  $\$11,500,000$  or

the Wei T'o equivalent production scale system at  $\$1,000,000$ , represents an excellent bargain for libraries.

### How deacidification meets library needs

The assumptions are that libraries want books to remain in usable condition for 400 years and that everything which could go wrong during this 400 years will go wrong. Many books may age more rapidly than accelerated aging tests estimate. Bad storage conditions may develop; and together with floods, fires, and other unanticipated events may reduce the benefit from deacidification by 50%. Consequently, as prudent professional managers, librarians must include a safety factor in their long range preservation plans.

This need for a safety factor led to the development of the Wei T'o Mass Preservation System. It is self-evident that both strengthening of weakened papers and protection against oxidative and biological attack are essential in the mass preservation programs that research libraries need; and that mass deacidification systems should be selected as only one component of a complete mass preservation program.

At best, even at the minimal costs of mass deacidification treatments, librarians will have no more than one opportunity every 100 or 200 years to protect the average book in a research library collection. Libraries have no choice but to establish

low-cost mass preservation treatments that both deacidify and strengthen each book treated. In other words, deacidification treatments should be selected, not only on the basis of how well they deacidify, but also on how compatible they are with treatments that provide the additional preservation protection needed in the future.

The type of mass preservation system foreseen by Wei T'o is estimated to extend the potential life of unstable acidic books by perhaps ten times. The concept of a mass preservation system was first put forward in 1968.<sup>9</sup> At that time only a proposed mass deacidification process existed, but today a proven mass deacidification process is available for use as the keystone in a mass preservation process.<sup>10</sup>

### Deacidification programs of national libraries

The mass deacidification programs of four national libraries (the British Library, Bibliothèque Nationale in France, National Library and Public Archives of Canada, and the Library of Congress) illustrate three of the five mass treatment approaches to collection management.

The British Library research program emphasizes strengthening, with mass deacidification as a secondary priority. Consideration is being given to including an amine in their strengthening agent so deacidification and strengthening can occur simultaneously. Unfortunately, in addition to having potentially hazardous physiological effects, amine deacidification agents discolor paper and react with nitrates and sulfates to produce acids.<sup>11</sup>

The National Library and Public Archives of Canada and Bibliothèque Nationale are applying the mass deacidification approach that was developed as one component in an all-round mass preservation program. This perspective, which is essential in the long run, is also the Wei T'o approach. It uses the organic solvent (liquified gas solution) technology to dissolve, transport, and impregnate the stabilizing alkaline deacidification chemicals. Using the same equipment used for mass deacidification, this liquified gas technique can be used to strengthen bound books and documents by impreg-

nating an acrylic resin. Magnesium alkoxides, after impregnation and before being modified into magnesium carbonate deacidification agents, can be used to catalyze-fast reactions of gaseous alkene oxides with unstable components in paper fibers. This treatment, together with magnesium's sequestering effect on trace metals, would greatly reduce oxidative attack and take only a few minutes. In addition, the impregnation of a nonharmful fungistat with the strengthening agent can be expected to prevent biological attack for at least fifty years, even in bad storage conditions.

The Library of Congress mass deacidification program using diethyl zinc (DEZ) is based upon the belief that the deterioration caused by acid attack is so overwhelming that the necessity for deacidification outweighs all other considerations. Peter Sparks, director of LC's Preservation Office, has stated that LC will look into mass gaseous strengthening after their diethyl zinc facility is operating.<sup>12</sup> Gaseous strengthening is a possibility, but I predict the economic and engineering problems of impregnating a vapor strengthening agent will eventually force the Library of Congress to consider the Wei T'o liquified gas strengthening approach mentioned above.<sup>13</sup> The inherent problems of vapor phase strengthening are: 1) books must be fully opened so all the leaves are separated about one millimeter apart during impregnation; and 2) the treatment cycle time is long because vapor phase impregnation of the large molecule strengthening agents is a slow, costly process when contrasted with transfer by liquid phase.

These are the three approaches to deacidification found in National Library preservation programs. A fourth and fifth approach should also be considered in addition to the use of microfilm, microfiche, optical discs, photocopying, and magnetic media in the place of unusable books.

The fourth approach is emphasized by all the libraries which you, the readers of this article, represent. That approach is one of active consideration and planning for the future. These libraries recognize that a terribly serious problem exists, and all libraries must help seek a practical solution.

The fifth approach is represented by all the libraries not practicing or considering mass deacidification. These libraries believe that deacidification is not important or that it is totally impossible to obtain funding for conservation work. These libraries must be recruited to help solve this problem whose pervasive implications are beginning to be understood by all other libraries.

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<sup>9</sup>Richard D. Smith, "Guidelines for Preservation," *Special Libraries* 59 (May-June 1968):346-52.

<sup>10</sup>Marianne Scott (National Librarian of Canada), "Mass Deacidification at the National Library of Canada," in *Proceedings of the Conference on Preservation of Library Materials, sponsored by the Conference of Directors of National Libraries, April 7-10, 1986, Vienna, Austria* (New York: K.G. Saur), in press. See also *Restaurator*, vol. 8, no. 1-2, in press.

<sup>11</sup>Richard D. Smith, "New Approaches to Preservation," *Library Quarterly* 40 (January 1970):139-71; Richard D. Smith, "Saving Our Books: A Chemical Problem," *ChemTech* 11 (July 1981):414-17.

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<sup>12</sup>Peter G. Sparks and Richard D. Smith, "Deacidification Dialogue," *C&RL News* 46 (January 1985):9-11.

<sup>13</sup>Bruce J. Humphrey, "Vapor Phase Consolidation of Books with the Parylene Polymers," *Journal of the American Institute for Conservation* 25 (Spring 1986):15-29.

## The state of mass deacidification in North America

The mass deacidification systems most familiar to American librarians are the functioning system in the National Library and Public Archives of Canada and the system proposed by the Library of Congress. Canada uses the Wei T'o Mass Deacidification System based upon chemical processing industry methods and technology. A pilot plant Wei T'o System has been in operation at the National Library and Public Archives of Canada for five years. This plant was originally built to obtain production data and it has worked very well. The full-scale system originally planned to follow it has not been built only because of financial retrenchment by the Canadian Government.

The two staff members who operate the pilot plant system in the National Library/Public Archives Building could deacidify 40,000 to 50,000 books per year during their 7<sup>1</sup>/<sub>2</sub>-hour day, five-day week work schedule. (A larger staff, perhaps seven persons, will be required each shift for a full-scale facility treating 1,000,000 books per year.)

The books, delivered by the National Library staff on book trucks, are double-checked for suitability for deacidification while being placed in baskets prior to vacuum drying. The baskets of bone-dry books are loaded, two baskets at a time, into the pressure chamber for the fifty-minute deacidification cycle. The liquified gas solution is forced into the books. Then they are vacuum dried to remove the liquified gas solvent and deposit the deacidification agent throughout each book. At the end of the cycle, the baskets of books are placed inside boxes overnight to return to room conditions. Then they are inspected and returned to the Library.

The cost of deacidification, including labor, chemicals, and maintenance, for this system was reported as US\$3.27 per book in April 1986 by the Public Archives of Canada.<sup>14</sup> The reuse of recovered solvents, projected to begin in 1987, is expected to reduce the treatment cost per book about \$0.75, i.e., to less than \$2.50 each. This projected low-unit-cost in the pilot-scale Wei T'o System represents a tremendous achievement, unthinkable only a few years ago.

The Library of Congress deacidification system of choice is the vapor phase diethyl zinc (DEZ) process. DEZ, though under severe review, still has a great potential when measured against the losses libraries are suffering in deteriorating books.

Since early 1986 various institutions, e.g., the U.S. Congress, *Library Journal*, and NASA, have

requested information and/or sought my counsel as a consequence of the mishaps at the DEZ Test Facility of the Library of Congress at NASA's Goddard Space Flight Center. This paper, originally presented in July 1986, has been revised at the request of *C&RL News* to include a summary of my conclusions about the DEZ Process based upon the information that has been published.<sup>15</sup> The well

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## *Preservation must be justified as protection of public property.*

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prepared and most detailed document, the NASA Goddard Space Flight Center's *Accident Investigation Board Report of Mishaps at the Deacidification Pilot Plant, Building 306 on December 5, 1985, and February 14, 1986*, alone contains first-hand information on the mishaps.<sup>16</sup> Wide differ-

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<sup>15</sup>"Engineering Problems Experienced at Deacidification Test Facility," *Library of Congress Information Bulletin*, March 17, 1986, p. 87; Joseph Palca, "Book Conservation: Red Faces Over US Pilot Plant," *Nature* 320 (1986):203; Karl Nyren, "Demolition Team Knocks Out LC Deacidification Plant: NASA Acts to Remove Danger Seen After Two Accidents Involving Library of Congress DEZ Process," *Library Journal* 111 (April 1, 1986):12-13; "Library's Book Deacidification Program Moves Forward Following Review of Incidents at Pilot Plant," *Library of Congress Information Bulletin*, July 7, 1986, pp. 255-56, 260; Peter G. Sparks, "LC's Mass Deacidification," letter to the editor, *Library Journal* 111 (August 1986):10, 14; Karl Nyren, "LC Reports Flaws in DEZ Process, Will Contract With Chemical Firm," *Library Journal* 111 (August 1986):22; "Book Deacidification Program Update: NASA Completes Accident Investigation," *Library of Congress Information Bulletin*, September 8, 1986, pp.310-11; Karl Nyren, "It's Time to Dump DEZ," *Library Journal* 111 (September 15, 1986):4; Karl Nyren, "The DEZ Process and The Library of Congress," *Library Journal* 111 (September 15, 1986):33-35; and "Deacidification Program Update," *Library of Congress Information Bulletin*, November 17, 1986, pp. 378-79.

<sup>16</sup>James H. Robinson Jr., et al., *National Aeronautics and Space Administration, Goddard Space Flight Center, Accident Investigation Board Report at the Deacidification Pilot Plant, Building 306 on December 5, 1985 and February 14, 1986* (Washington, D.C.: NASA Goddard Space Flight Center, September 4, 1986). Note: This report has not been widely distributed to date; the edition cited here was routed from NASA to the Library of Congress to the U.S. Congress to the author, who received it on October 6, 1986.

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<sup>14</sup>Geoffrey Morrow, "Mass Deacidification: Operational Experience at the Public Archives and the National Library of Canada," in *Proceedings of New Directions in Paper Conservation, 10th Anniversary Conference of The Institute of Paper Conservation, April 14-18, 1986, at Oxford University, England*, in press.

ences of opinion regarding the implication of these mishaps are reported in articles in *Library of Congress Information Bulletin*, *Library Journal*, and *Nature*. Concerned librarians should examine all eleven of these publications, plus any other information which may later become available, and reach their own conclusions regarding the causes of the mishaps and their impact on library preservation.

My personal impression, from reading statements of individuals involved, is that the NASA report clearly suggests personnel at all three organizations, the Library of Congress, NASA, and Northrop Services, Inc., were delinquent in fulfilling their responsibilities. Three basic signs of inadequacy are repeatedly evident: 1) a pervasive low quality of technical and engineering work; 2) a systemic deficiency in administrative control and leadership; and 3) in all three parties a lack of understanding regarding the inherent hazards of working with DEZ. Karl Nyren, senior editor at *Library Journal*, may have erred in equating the mishaps with the *Challenger* disaster.<sup>17</sup> However, the NASA report does indicate that the overall caliber of work in the DEZ project was not up to accepted professional standards.<sup>18</sup>

On one hand, the Library of Congress has criticized the other parties, especially Northrop Services, and has oriented attention towards the DEZ Test Facility mishaps. On the other hand, the specifications and drawings distributed by the U.S. Army Corps of Engineers with its Solicitation for bids, supposedly present comprehensive engineering information for construction of the full-scale DEZ Facility.<sup>19</sup> This Solicitation, prepared with instruction from the Library itself and approved by the U.S. Army Corps of Engineers, is evidence that the Library was a full party. Moreover, as one example, the definition (p. 13A-8) for diethyl zinc ("DEZ, a clear, colorless liquid at atmospheric and ambient conditions, igniting on contact with air, reacting violently on contact with water, but does not react with carbon dioxide, nitrogen, or helium") falls woefully short of the chemical engineering data essential to prepare reliable bids.

This incompleteness also extends to the lack of appreciation in fully understanding the inherent hazards of working with DEZ (a conclusion of the NASA report) by U.S. Army personnel. Withdrawal of this Solicitation indicates the Library desperately needs unbiased, independent advice. It is possible the House Appropriations Committee

may renew its interest in this project and provide the Library of Congress with such advice during the next Session of Congress. If hearings take place, interested librarians should follow them.<sup>20</sup>

### Funding mass deacidification programs

The books we have placed in libraries are essential in this, the Information Age. In most cases, these books are public property which must be preserved by law. In order to carry out this responsibility, most libraries will require additional funds. To obtain increased funding, libraries must show greater public benefit when they compete with police, highway, welfare, education, and other civic services. Library preservation funding requests to date have demonstrated that preservation work cannot be funded simply to preserve ideas written down in books.

Librarians must use the same successful techniques that police and firemen use; that is, justify preservation to protect the public and public property. Unintentionally in their funding requests, librarians have put the cart in front of the horse. For example, roads and bridges are not maintained because we drive over them. Highway systems are maintained because they are public property and elected officials would be replaced if the roads within their jurisdiction became unusable. The benefit, not the funding legality of protecting public property, is that we can visit a friend or receive a delivery. Analogously, a researcher obtains a new idea or insight from reading a book. Librarians should use these same arguments when seeking funds to preserve the books, that is, the public property for which they are responsible.

The library cost/benefit ratio or rate of payback, if measured by Wall Street standards, makes mass deacidification so inexpensive that the absence of its use in libraries seems absurd. For example, the present deacidification cost in the Wei T'o Pilot Plant in Canada can be independently verified at US\$3.27 per book.<sup>21</sup> As calculated above, the yearly savings from deacidification of US\$3.60 per book produce a payback under one year. The projected, direct costs for treatment in full-scale Wei T'o Systems are even less—under US\$2.00 per book in a well-run not-for-profit operation. Such benefits are simply unheard of in present day society...extending an object's life by four times for a one-time charge of 2-3% of its replacement cost.

Given that libraries desire mass deacidification, funds for the deacidification of new acquisitions should be requested as a regular budget item. This is the same way libraries request funds for telephones, bookmobiles, book theft detection sys-

<sup>20</sup>Transcripts of Congressional hearings may be ordered from the Miller Reporting Company Inc., 507 C Street, N.E., Washington, D.C. 20002, (202) 545-6666; or from CIS.

<sup>21</sup>Morrow, "Mass Deacidification."

<sup>17</sup>Nyren, "It's Time to Dump DEZ," 4.

<sup>18</sup>Robinson, et al., *Accident Investigation Board Report*.

<sup>19</sup>Solicitation for The Library of Congress Book Deacidification Facility, Fort Detrick, Maryland (Invitation No. DACA31-8-0013), issued January 15, 1986, by the Department of the Army, Corps of Engineers, Baltimore District, Corps of Baltimore, Room 1231, 31 Hopkins Plaza, Baltimore, MD 21201-1715.

tems, cooperative computerized cataloging, database searching, online circulation control systems including interlibrary loan services, all unknown until the 20th century.

The solicitation of funding for the mass deacidification of retrospective book collections should be directed towards supplementary one-time appropriations. It is true the funding needed does appear large until a review of the value to research libraries puts the dollar amount into perspective. Then mass deacidification becomes, not only an extraordinary bargain, but an essential public service that is mandated by law.

### Choosing a mass deacidification system: A personal perspective

Nonaqueous (gaseous or solvent) deacidification has come of age. From virtually no choices 25 years ago, librarians today can select between gaseous and liquid systems, between a variety of large and small-scale techniques, and between a variety of application methods and chemicals.<sup>22</sup> This abundance of choice is even more startling if one remembers that less than 20 years ago, the Committee for Paper Problems, International Institute for Conservation-American Group, formally reported: "A nonaqueous means of deacidification that would not be harmful to paper, pigments, and the various media must be developed."<sup>23</sup>

Perhaps it is inappropriate, as an involved party, for me to use the Wei T'o System as an example of the state of the mass deacidification art, but its evolution does demonstrate several critical aspects for successful development projects. These aspects include maintaining scrupulous scientific rigor and objectivity; choosing a lead person or group whose primary qualifications are breadth of technical knowledge and industrial chemical engineering experience in developing and installing new technology; thoroughly involving librarians, engineers, and operating personnel in the decision making; using specially selected teams of experts for specific tasks; and delegating overall administrative control and/or review to independent decision makers, e.g., preferably to the preservation librarians who must make the end product of the development project work.

The Wei T'o technology was originally developed as part of my Ph.D. research at the Graduate Library School of the University of Chicago. This research was supervised by an unparalleled team of

engineers, scientists, and librarians from industry, the University of Chicago, and the Institute of Paper Chemistry. The development and installation of the pilot plant scale Wei T'o Nonaqueous Book Deacidification System in Canada also brought together an extraordinary group. Major corporations like DuPont and York Division, Borg-Warner, together with smaller vendors and builders, shared their technologies to meet previously unknown engineering requirements. My first deacidification agent, magnesium methoxide, was improved by George B. Kelly Jr., chemist at the Preservation Office of the Library of Congress.<sup>24</sup> Many Wei T'o improvements have followed since that time, and the Wei T'o process is used by the National Library and Public Archives of Canada, the British Library, and the Bibliothèque Nationale in France. The general acceptance of this technology by museum and book conservation laboratories throughout North America underscores its versatility and applicability.

National TV news releases on library preservation and mass deacidification directly recognize the importance of libraries to society. The "Science Notes" educational presentation (Autumn 1986) by Public Broadcasting System's KQED-TV San Francisco Station explains the Wei T'o System and provides general background on book deterioration. The "How About Saving Old Books" news release (April 1986), sponsored by the National Science Foundation and General Motors Research Laboratories, recognizes the System as an advancement in science and technology. The American Chemical Society's "Fountain of Youth For Library Books" news release (May 1984) uses Wei T'o as an example of good chemistry and chemical engineering. Videotapes of these three news releases are available from Wei T'o Associates for educational use by libraries.

The Wei T'o liquified gas mass deacidification approach has been identified before Congress as unsuitable for use at the Library of Congress. The reasons given were: 1) the Wei T'o process requires a pre-selection of books because some books may be defaced by the treatment; and 2) the production potential is insufficient to meet the Library's needs. During five years of operating experience, the need to identify and protect the few books with sensitive inks has not been found either excessive or expensive at the National Library and Public Archives of Canada. Perhaps more importantly, some new chemicals and technology that Wei T'o will introduce shortly, may provide a basis on which to lay this pre-selection fallacy to rest.\*

With reference to the potential capacity of the Wei T'o System, the Library of Congress has always quoted to Congress the originally specified

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<sup>22</sup>Richard D. Smith, "Nonaqueous Deacidification: Its Philosophies, Origin, Development, and Status," in *Proceedings of New Directions in Paper Conservation, 10th Annual Conference of The Institute of Paper Conservation, April 14-18, 1986, at Oxford University, England*, in press.

<sup>23</sup>"Report of the Committee for Paper Problems," *Bulletin of the American Group, The International Institute for Conservation of Historic and Artistic Works* 9 (October 1968):30.

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<sup>24</sup>"Library Licensed to Make Deacidification Solution," *Library of Congress Information Bulletin*, April 9, 1982, pp. 110-12.

\*See the "New Technology" column in this issue of *C&RL News* for more information.-Ed.



output of the Wei T'o "pilot plant" System of 30 books per cycle, five cycles per 7.5 hour shift, one shift per day, five workdays per week. This statement is misleading because it compares an existing reality with a possible future. On one hand, an existing, actually operating Wei T'o pilot plant is being compared with a non-operating, full-scale plant, whose production is projected by LC with an operation running 24 hours per day, seven days per week. On the other hand, the scaling up to 645,000 books per year in the Wei T'o System standard unit: 1) involves only doubling the size of the treatment chamber and adjusting the size of peripheral components, and 2) is on a scale where future operational results are literally guaranteed from past operating experience. (These standard units may be replicated when greater production capacity is desired because duplication, in this instance, is more effective than building bigger.)

By comparison, scaling-up at the Library's Fort Detrick facility is projected primarily based on a scaling-up factor of 50 to 75 times rather than two times, data from thirteen unpublished tests of up to 100 books each rather than five years of production experience,<sup>25</sup> and changing from a laboratory "use once and discard" chemical test philosophy to a

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<sup>25</sup>"Book Deacidification Program Update," 310-11; and Nyren, "The DEZ Process and the Library of Congress," 33-35. The 5,000-book test was run but once and works against rather than provides justification for scaling up the DEZ System to production operations for two reasons: 1) 2,000 (40%) of the books were incompletely or not at all deacidified; and 2) many of the remaining 3,000 were defaced by white deposits (named the Tiffany Effect at LC). The 13 tests of up to 100 books each are an effort to overcome these problems. See Sparks and Smith, "Deacidification Dialogue," 11.

"recapture and recycle" production scale operation.

A cost comparison of the respective full-scale systems is difficult to make because only limited information exists. My expectation is the installed cost of a Wei T'o System of comparable production capacity would be less than 15% of the projected installed cost of the upcoming LC DEZ facility at Fort Detrick. The unit-deacidification-costs per book for the Wei T'o System have been estimated based on operational experience. At this time equivalent cost information does not exist for the DEZ System.

Libraries should not take the emergence of Wei T'o technology reported here as a guarantee that all of their mass preservation problems have been solved. What has occurred is that the door to solving these problems has been opened wide; but much remains to be done before the books in library collections reach the Promised Land. The recognition given Wei T'o means that libraries are no longer standing alone and this problem is beginning to achieve the visibility that it deserves. Significant understanding of the library preservation problem now exists within industry, science, and the general public. Librarians have a solid technology as well as an economic justification with which to undertake planning of their strategies for preserving their library collections. Detailed information to help libraries choose between different mass deacidification systems will be published shortly in a critical study by George M. Cunha, "Mass Deacidification for Libraries." This study has been commissioned by the American Library Association's *Library Technology Reports*.<sup>26</sup> ■ ■

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<sup>26</sup>George M. Cunha, "Mass Deacidification for Libraries," *Library Technology Reports*, in preparation.

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## Promotional materials for National Library Week

The American Library Association's Public Information Office has some new library promotional products for this year's National Library Week, April 5-11. The theme, "Take Time to Read," also fits in with 1987 as the Year of the Reader.

Brand new this year is a 17" x 22" "Key into the Library" poster (\$4). "When you absolutely positively have to know, ask a librarian" is the theme for several new items, including a banner (7" x 31", \$3), bookmarks (\$6 for 200), and memo pads (5" x 8", 100 pages/pad, \$5 for 4 pads).

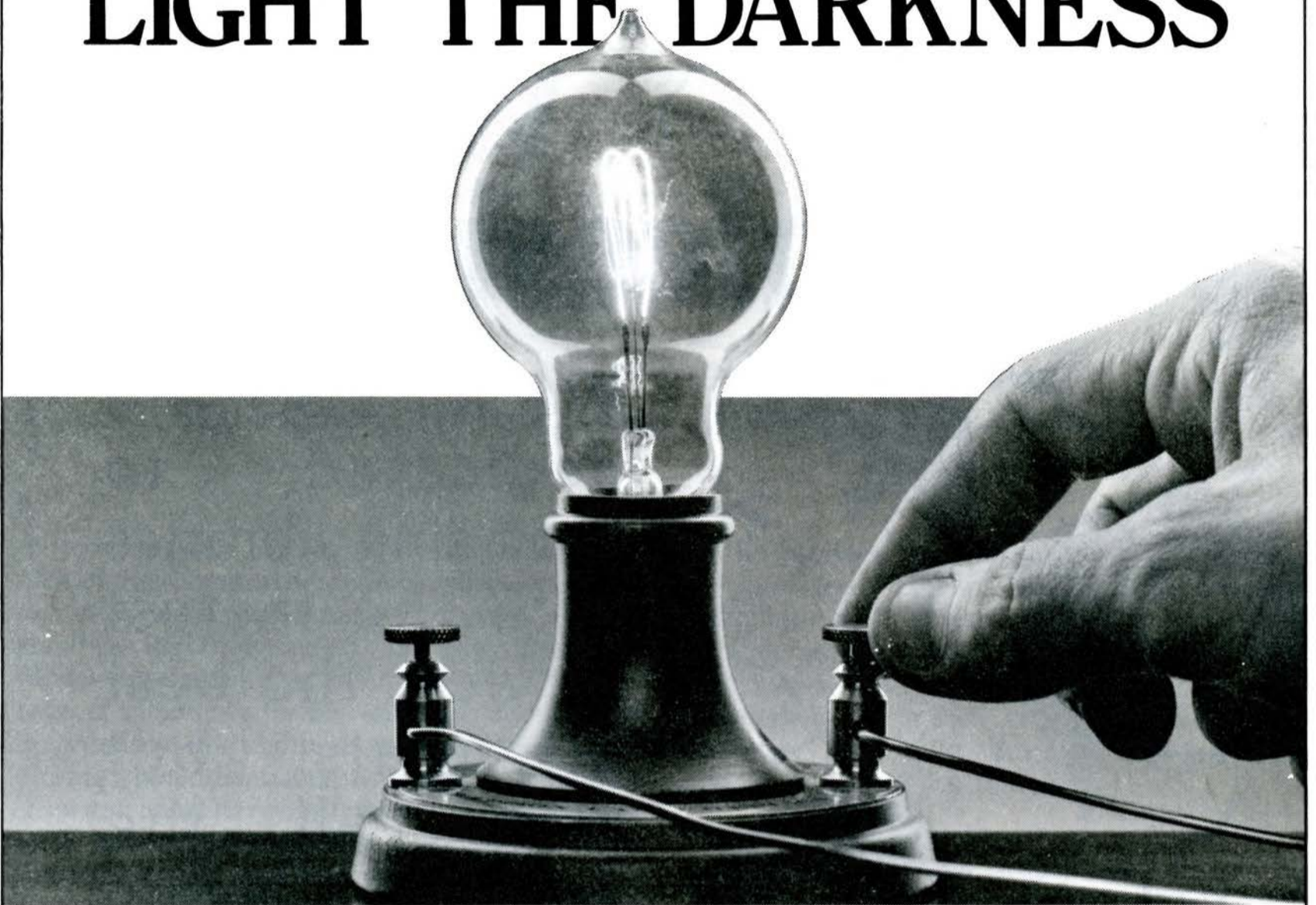
Other theme products are a wristwatch, rubber stamp and stamp pad, television public service spot, and a Year of the Reader wall planner with ALA conference dates and other reading-related events. To order any promotional products or a

catalog, contact: ALA Graphics, Public Information Office, 50 E. Huron St., Chicago, IL 60611; (800) 545-2433, x235. ■ ■

### NOTIS users' meeting

The first regional meeting of NOTIS users was held November 20-21 at Southwest Missouri State University's Meyer Library in Springfield, Missouri. John Meador Jr., dean of library services at Southwest, hosted the session for all seven Missouri NOTIS user institutions and NOTIS representatives, Jane Burke, Jorge Fernandez, and Mary Alice Ball. Discussions included applications updates and projections of statewide nnetworking.

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