

CONSTRUCTION AND START-UP OF THE  
DEACIDIFICATION UNIT AT PRINCETON UNIVERSITY LIBRARY

by Robert A Parliament

INTRODUCTION The degradation of paper due to its acid content is a well documented problem. At Princeton, we felt it should be a priority to begin to deacidify materials routinely. Actual planning for the unit started over 18 months ago, but in October 1982 we received a Title II-C Grant which in part covered the capital cost. The grant also covered the cost of two deacidification projects for Rare Books: the Holden Collection on the History of Women and a collection of Edwardian novels.

Certainly the technology is presently available. We followed a non-aqueous spray format similar to that found in many conservation facilities. The common one-off approach with one work station in a laboratory fume hood was multiplied by five to produce a custom designed large scale spray deacidification system. Much of the technique and design was based upon 10 years previous experience in routine spray deacidification while in private practice.

The unit is a result of an attempt to find middle ground between the one-off approach and the mass systems. It has a moderate capital cost within the reach of many organizations with collections similar to Princeton. Regardless of the future developments in mass deacidification, this system will have a long term application for rare and special collections.

THE PROJECT This one-year project focuses on deacidifying, cataloguing, and partial boxing and microfilming of 670 rare books in women's history and 732 Edwardian novels printed between 1900 and 1914. Funding is provided under the provisions of the Higher Education Act Title II-C Strengthening Library Resources Program.

The Holden Collection on the History of Women was assembled by Miriam Y. Holden and presented to Princeton after her death. It contains a fine assortment of books, periodicals, manuscripts, clippings, photographs, cartoons, letters, and other materials about women and their achievements.

The Edwardian novels are a group of lesser known authors recently purchased from a British bookseller. During the early 20th century the library collected only major authors and acquisition of these materials is to compensate for the earlier bias. The collection covers many common types of Edwardian novels: historical, regional, romantic, sensational, political, and working class.

**OVERVIEW**            The spray system delivers the Wei T'o #2 (Methoxy magnesium methyl carbonate) to the paper. The operator applies the solution page by page to books or one surface at a time to individual documents and works of art on paper. The ventilation system carries away overspray, allows the operator to work under safe conditions and provides support for the item in treatment. The operators are primarily student assistants. Screening of items for treatment, quality control, training and system maintenance are provided by the Head of Treatments.

**DESIGN**            Spray Equipment -- Most of the components are readily available. The compressor provides the air supply, which is cooled in a refrigerated dryer. Oil and water are then removed in a separator/accumulator. The air travels via copper tubing to the deacidification unit. Wei T'o Solution #2, shipped to us in 12.5 gallon cylinders, is decanted into 2 stainless steel pressure pots. The two pots allow continual operation; while one is supplying solution, the other may be filled.

There are five work stations with one spray gun each. The guns are Devilbis TGA-515 with stainless steel fluid passages. The solution is conveyed to the guns through standard fluid hoses and stainless steel piping. The fluid hose at the gun has a quick disconnect, enabling the operator to easily switch to the cleaning line. A turbulent mixture of air and methanol is supplied from a special pressure pot, through stainless lines, to the work station, allowing convenient clean-up at the day's end. Air is supplied to the guns and the pressure pots through a manifold with valves for each line. The air passes through a regulator/separator/accumulator, at each station, before entering the gun. Stainless steel components were incorporated into the spray system where ever possible to minimize the corrosive effects of the Wei T'o solution vapors and facilitate clean-up.

Ventilation Equipment -- The ventilation system is very complex and was custom designed to provide efficient work stations, facilitate application of the solution, capture the overspray, and ventilate the work area. The system is comprised of five spray booths. Each is controlled by a blast gate, a branch duct collection system leading to a 15" diameter duct, a silencer, a Strobic Air "Contr-Rotating" in-line tube axial fan, a pair of back draft dampers and a pair of louvers directing the exhaust downwards.

The spray booths have an outer filter which acts as a support for the material being treated. It also filters some particulate matter from the overspray. The inner filter removes further particulate matter and assists in turning the air from a horizontal to a vertical path.

The fan unit has two motors which are regulated by a Reliance Electric AC Variable Speed Drive Controller. This in turn is regulated by a Process Controller Interface. The interface interprets the signal from a pneumatic-electric Transducer, connected to an in-duct sensor ahead of the fan. The in-duct sensor monitors the static pressure of the system and provides a pneumatic signal to the Transducer. Static pressure is related to the suction that is required to overcome the resistance to the movement of air in the system.

The fan unit is actually two fans: one rotating clockwise, the other counter clockwise. This provides better velocity control at low speeds, than a single fan. The speed of the induction motors may be changed by varying the electrical cycles per second from 6 to 60 through the speed drive controller. The controls monitoring the static pressure and regulating fan speed are required to maintain constant face velocity at each booth that is in operation. When the blast gate of an additional booth is opened, the static pressure of the system drops; the controls then increase the speed of the fans to maintain the correct static pressure.

The ventilation system was designed to provide a minimum face velocity at each booth of 100 ft/m with a book or document in place. A velocity below that required for a standard fume hood is a realistic goal because the spray is directed into the booth by the operator's gun. The particular design of the booths as receiving hoods facilitates the flow of ventilation air. The two design principle allows a low velocity which does not compromise the operator's safety.

**PROCEDURE**        Each Wei T'o cylinder is decanted into the pressure pots five gallons at a time. Spraying is accomplished with relatively low pressures: 20 PSI on the pressure pots and 8 PSI of atomization air. One operator works at each station and one to five of the booths may be used effectively at any time. Each operator wears an ambidextrous vinyl glove on the hand used for turning the pages. Flexible protective goggles or prescription glasses are also required. Additional vinyl gloves are available for operators who wish to use them.

Items are routinely reviewed for suitability for deacidification. As required, ink inscriptions, illustrations, and unusual components are spot tested for solubility and color change. The pages of all books are interleaved every 15 sheets with paper towelling to prevent a build-up of the overspray which may alter the color of the paper. Leather bindings, head bands, head caps, and other pH sensitive materials are wrapped with aluminum foil for additional protection. The covers of most cloth bound books are not protected. The book is then placed on the outer filter, and the leaves turned one at a time as they are sprayed. An

average size book (5" X 8", 300 pages) is handled with two to three passes of the gun across the open pages and takes approximately twenty to forty-five minutes to complete, depending on the sheet size and thickness of the paper. It is then air dried, with the pages fanned out for one to two hours and then placed under a weight. The weighted items are checked four times a day to assure they are completely dry. At any time they may be refanned for further drying. Once dry, a pencil note is made in the book next to the call number: "Deacidified" -- the date and operator's initials.

**CONCLUSIONS TO DATE** After initial start-up the system is operating much as designed. It is over built in the sense that it has the capacity to move more ventilation air than is required for safe operation. There is some variance in the individual performance of the five guns, affecting the breadth of the spray pattern. This appears to be partly the poor quality of some of the parts, and lack of clean up by the installer of the system. Regular and thorough cleaning of the guns is essential as it has a major effect on their operation. The system has been easy to use, and as operator experience grows, consumption of solution, relative to pages treated, is decreasing. One operator should be able to treat 4-5 books in a four hour shift, using less than one quart of solution for the average size book. Since we are at the beginning of the treatment section of the project it will be several months before we can report specific experience handling a large number of items. However it is clear that we have succeeded in developing a system which is middle ground between the one-off approach and mass treatment systems.

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