

SPECIFICATIONS FOR A HARD-BOARD LACED-IN CONSERVATION BINDING

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Introduction

The study of historical bookbindings by the book conservator is both a descriptive and normative process. The documentation of a book's components is by its very nature a descriptive process in which the conservator takes inventory of the various materials and techniques used to assemble books. The process is also normative, for the conservator seeks to ascertain why some materials and techniques survive and some do not. Furthermore, besides the mere survival of certain materials, the book conservator is keenly interested in whether or not those materials will continue to function in the manner originally intended. Ultimately one hopes to understand how and why certain binding techniques produce books which continue to be functional for centuries. The normative aspect then, involves making judgements about the methods of binding books, with the goal of establishing a standard for the ideal bookbinding.

While the process of conserving books attempts to preserve intact as many components of the original book as possible, including the binding, the failure of some or all of the constituent parts often makes the rebinding of the book inevitable. Rather than

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viewing this process as ahistorical, one might reasonably expect that a dynamic object such as a bookbinding will gradually break down with usage and have to be rebuilt. Viewed in this manner, book conservation has much in common with the approach of traditional Japanese scroll mounting.

The process of remounting is considered a periodic necessity in maintaining the life of the scroll. Japanese scrolls suffer from various forms of deterioration largely related to the patterns of use, i.e. the rolling and unrolling of the scroll. Much of this deterioration, including the creasing, losses and tears in the support, flaking of the paint layer, etc., can be stabilized through the process of remounting.¹ The great advantage that traditional Japanese scroll mounting has over book conservation lies in the continuity of the techniques and materials used, standardized and passed on from master to apprentice for many centuries.²

Likewise, few books will survive in a single binding. And in a similar manner, the process of rebinding can be an opportunity for abating much of the deterioration of the book, if suitable techniques and materials are used. The approach of book conservation differs most significantly from the remounting of Japanese scrolls in its lack of a well-defined body of technique that can be applied in any uniform manner to the great variety of books and bindings that exist in the history of the Western codex.

The significance of a book's binding can be understood in both functional and historical terms. Functionally, the binding is in a position of service to the text, protecting and preserving its

contents, while allowing the leaves to be perused at any point in the text. Historically the binding is often intrinsically related to the text, important from a bibliographical and artifactual standpoint. Determining how to best preserve both the functional and historical aspects of a binding places a difficult evaluative responsibility on the book conservator, requiring the following judgments:

1. To what extent has a binding ceased to fulfill its purpose of protecting a text and allowing it to be read?
2. To what extent may the binding be endangering the text?

From these two questions we arrive at the crucial third question:

Which conservation measures offer the best approach to preserving the text and the binding?

The preservation of many early books is effectively secured by the construction of protective containers. This is especially appropriate for books whose original bindings are of great artifactual value and whose binding structures are usually the most stable. However, conservation bindings are frequently necessary for early books in later bindings, and for books originally bound using inferior materials and/or techniques. In these cases, the preservation of the existing components of the binding is often best carried out apart from the text. Simple containers constructed for housing and preserving the original materials can be boxed together with the text. This method avoids reincorporating deteriorated materials into a conservation binding, and consequently prevents further damage to the original materials and likely damage to the conservation binding.

Certainly a conservation binding which uses techniques inferior to those used in the earlier binding is not desirable. Here the careful observation of historical bindings, evaluating the techniques and materials used in the past, clearly plays an important role. Indeed, the process of studying earlier bindings and differentiating between the successes and the failures, is often the only means by which we rediscover the masterful techniques such as those used by the late medieval and early renaissance bookbinders.

It seems inevitable that the evaluation of historical bookbindings leads to a gradual sorting of types of bindings and particular features of bindings into two categories: Those which have and have not been effective. From this follows an attempt to derive ideal models for different types of conservation bindings. Examples of types of historical bindings synthesized into coherent models for conservation bindings are found in the work of Christopher Clarkson with limp-vellum bindings, and Gary Frost with paper-cased bindings.^{3,4}

My particular interest has been in developing a model for a hard-board, laced-in binding which would be suitable for a wide range of texts. My belief is that the basic features of such a binding can be derived from successful historical bindings on books in various formats and sizes, and can be applied with only minor variations to a great variety of books. It is also my conviction that a hard-board, laced-in binding structure need not be excessively complicated, and is appropriate in many cases where limp-vellum or paper-cased structures are not. It is hoped that

this model, outlined in the specifications which follow, will demonstrate the effective application of early binding techniques in producing a durable and functional hard-board, laced-in binding.

The development of this idealized model represents a synthesis of various bookbinding techniques and conservation principles. Certain characteristics common to most early European bindings, especially those of fifteenth- and sixteenth-century Germany, have been incorporated. These historical techniques include a well-integrated sewing structure and board attachment system, a mechanical, rather than adhesive-dependent structure and the use of stronger, more substantial materials throughout. In addition, emphasis has been placed on maintaining pliability and reversibility where it is most essential: in the workings of the spine. Most importantly, an attempt has been made to simplify while integrating all the components of the binding, and to distinguish between function and form, resulting in a conservation binding whose final appearance is the result of the honest and direct techniques employed.

This represents a first attempt to characterize this model, and much experimentation and refinement remains to be done. Nevertheless, conservation bindings have been executed, using some or all of the features of this model, with positive results over the past three years. The development of this model owes much to work carried out at the Library of Congress. My discussions during the past five years with colleagues in the Restoration Office have been especially important. Discussions with Peter Waters about the nature of book structure, and his comments and suggestions, with

references to work carried out in the Roger Powell Workshop,⁵ provided many ideas which are basic to this model. Much of the evaluation and discussion of book structures took place in the Restoration Office workshop, often the result of group insights, buoyed by the keen eye and analysis of Glen Ruzicka. The opportunity to more fully implement and refine this model has been provided by recent work in the Conservation Laboratory of the Harold B. Lee Library at Brigham Young University. A gratifying effect of this work has been the opportunity to teach conservation binding in a more direct manner, where the relationship of a particular technique to its purpose is clearly defined and understood.

Specifications for a Hard-Board Laced-in Conservation Binding

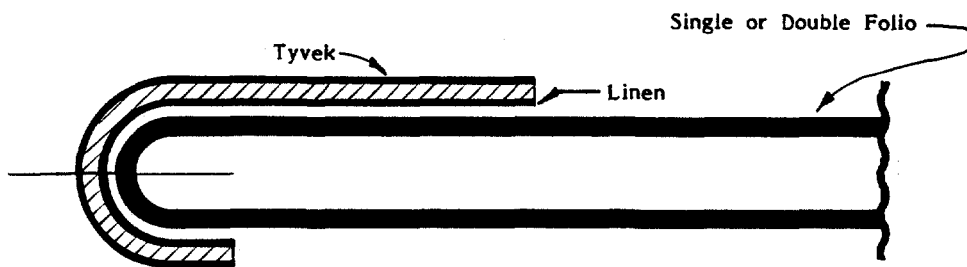
Endleaves

Endleaves are made from the strongest handmade sheets available which meet conservation standards of permanance and durability. There are relatively few contemporary handmade sheets produced with the proper characteristics, which are compatible with early book papers. Our choice is a loft-dried handmade sheet of 60 percent unbleached cotton muslin, 40 percent unbleached linen, with a basis weight of 85-90 g/m² (about .007-.008 inches). This paper is available unsized or internally sized; our workshop typically orders unsized sheets which are subsequently parchment-gelatine sized in the workshop. This paper is Kalamazoo Book Paper No. 3.⁶

Endleaves are constructed of a simple single or double folio, reinforced with a joint guard of a linen/Tyvek⁷ laminate (laminated with PVA). This guard is not adhered to either the endleaf section or to the adjoining text section. A free guard around the first and last text sections may be used, to which one may tip the joint guard. A separate board paper or paste-down is used, positioned to reveal a minimum amount of linen joint. This eliminates the strain imposed upon the endleaves by the traditional process.

Traditionally, one folio leaf is adhered to the inner board while its conjugate leaf is left free as a flyleaf. Of the two leaves, only the adhered leaf expands, causing a strain on that folio at the joint.

Diagram 1



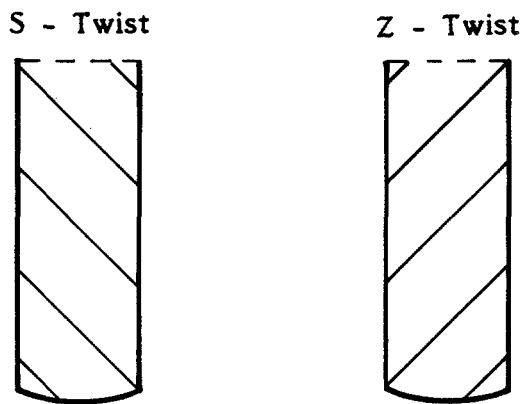
Sewing

Of the many components in a hard-board laced-in binding structure, the sewing supports are of paramount importance. No single element contributes more to the actual workings of the binding, nor undergoes more stress through usage, especially at the joints, than the sewing supports. The central structural role played by the sewing supports, and dissatisfaction with the material

presently available as bookbinder's cord, has placed a high priority on improving the quality of this material. Since the material should be of an equal or greater quality than the sewing thread, the logical step is to construct the sewing supports from multiples of the sewing thread.

Sewing supports in this workshop are constructed from multiples of Barbour's Linen Bookbinding thread,⁸ following the principles used in simple ropemaking. A few definitions of ropemaking terminology will help to clarify this process.⁹ The twist in any strand can be either right-handed (Z) or left-handed (S), which denotes the angle of twist relative to the horizontal axis of the strand. It is essential to identify the twist direction of any strand before combining strands to form a rope. (See Diagram 2)

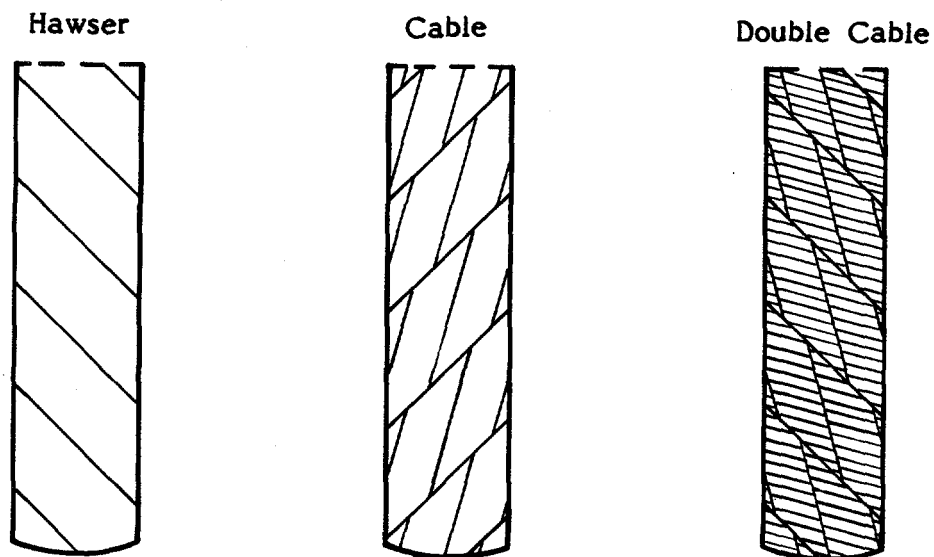
Diagram 2



A hawser-laid rope, also known as a plain-laid rope, is a rope made of three or more strands, laid together in the opposite direction to the strand twist. Rope made of three or more strands, each of which is a hawser-laid rope, is known as a cable-laid rope. The lay or twist in the cable is opposite to the lay in the hawsers.

The cable has greater elasticity and flexibility than a hawser of equal circumference, and produces a rope of high breaking strain and resistance to abrasion, distortion and wear. Although no specific term has been found to denote a rope made of three or more strands, each of which is a cable, we shall here refer to it as a double-cable. Similarly, the lay in the double-cable is opposite to the lay in the component cables. A cabled or double-cabled rope is easy to recognize by the differentiation among the strands. (See Diagram 3)

Diagram 3



With this in mind let us proceed to the making of cord from linen thread. An individual linen thread is already analagous to a hawser: it is composed of linen strands (or plies) laid together in the opposite direction to the strand twist. It is commonly available in either two or three ply, in a variety of weights; and

can be either "S" or "Z" twist. Common bookbinder's cord is also usually a hawser, but may be anywhere from three to twelve ply.

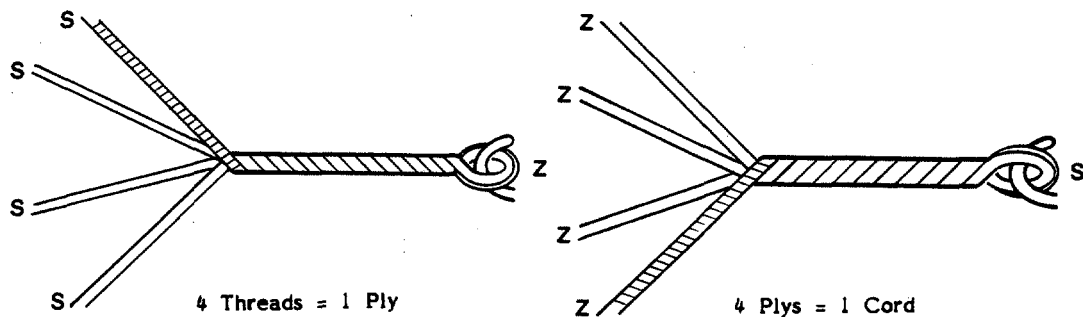
Cords in our workshop are spun by hand, horizontally as in a traditional ropewalk, and the degree of twist, and therefore tension, is monitored by visual observation and feel. At each level of cordmaking, the uniformity in the cord is produced by maintaining equal tension in the strands. In our system, each cord is composed of a number of plys, and each ply a number of threads. Since each thread corresponds to a hawser, each ply is a cable, and the final cord is a double-cable.

A cord can be made with any number of threads twisted to form a ply, and any number of plys twisted to form a cord. In actual practice, we found that plys composed of two, three, or four threads, and cords of four plys work well, are produced easily, and result in a very round cord. Different weights of cord are produced by varying the number of threads in a ply, and by varying the weight of the thread used. Obviously, the endless possible combinations of weights of thread, numbers of threads, and numbers of plys will produce any size cord desired. The distinct advantage of this double-cabled system is that cords which are very strong and flexible can be produced in much thinner diameters than those commercially available of comparable strength. This plays an important role in producing a supported sewing system which is also very flexible.

Multiples of four are easy to work with in a hand-spun system because both the threads and the plys can be looped over a hook for the laying or twisting process. Typically, the plys are formed of

four threads, by looping two long threads over a hook, which are twisted together after knotting the ends, in a direction opposite to the twist in the threads. Two four-thread plys are also looped over a hook, with the resulting four plys twisted counter to the first twisting to produce the cord. In summary, two threads, each two meters in length, are folded in half to form plys of one meter, two of which are folded in half to form a four-ply cord of half a meter. These in turn will form double cords of a quarter meter--a useful length for most books. (See Diagram 4)

Diagram 4



For hand-spun cord, the use of the hook and the looping process insures a cord which resists unraveling once the lay is set. The lay of the double cable is set by twisting the plys as far as possible, which when released produce the final lay. Knotting the ends of the cords inhibits any inadvertent unraveling.

Double supports are used for sewing, and are generally stationed between 3 cm and 6 cm apart. Their position is often determined by the location of previous sewing holes. The kettle stations are located no more than 2 cm from head and tail, and

preferably at about 1 cm. The kettle stations are reinforced with a sewing thread, stretched on the sewing frame like the other supports, around which the kettle-stitches are sewn. The tail of the starting thread used for sewing can become one kettle-reinforcing thread, while a separate thread is used at the other kettle station. This treatment of the kettle-stations does not attempt to conceal them; instead, it emphasizes the additional strength that a supported kettle-station affords.

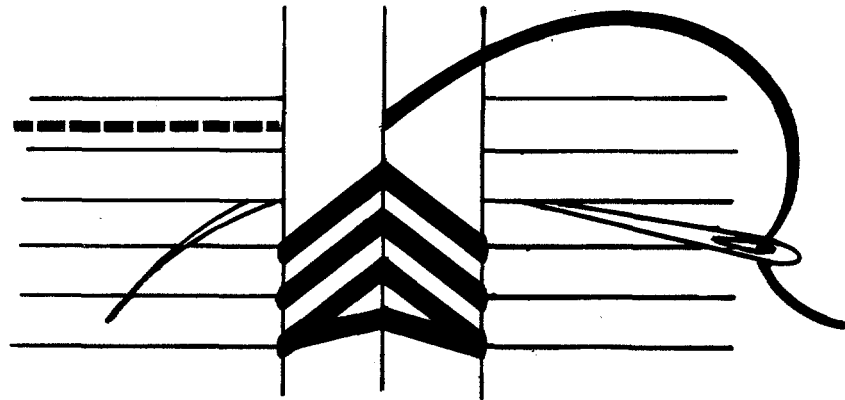
The choice of sewing thread, i.e., the weight of sewing thread, is governed by several factors: a) the number of sections, b) the thickness of sections, and c) the thickness and surface quality of the paper. The swelling of the spine through the build-up of thread must be controlled. But the governing principle is to choose a heavier thread wherever possible. Most books can be sewn with a 20/3 or 25/3 thread, but those with a great many sections, often four-leaf sections, may require a 30/3 or 35/3 thread. In many cases, resorting to a symmetrical two-on arrangement is preferable to choosing a lighter thread.

The swelling from the thread build-up can be minimized by two factors: 1) abandoning the practice of waxing the thread prior to sewing, and 2) compacting each section firmly and evenly after it is sewn, using a flat stick. The stick, positioned between the sewing supports and extending from spine to fore-edge, is tapped with a mallet. An unwaxed thread presents no difficulties in sewing and is a natural advantage since it is more easily flattened when compacting the sections. A hard, waxed thread impedes this process. It should also be noted that Barbour's Satin Finish Linen

Bookbinder's Thread comes pre-waxed, which may be less preferable to a "soft" finish or unwaxed thread.¹⁰ From evidence found in early books, we know that early binders used much heavier thread, and that this thread was well flattened within the section. Part of the secret of the compact nature of the spines of early books, perhaps lies in the greater ability to flatten the sewing thread.

The sewing pattern employs a herringbone link stitch, usually sewn all-along. The herringbone link stitch is sewn with a curved needle which circles the double-bands between the second or third section below the section being sewn, thus catching-up the sewing of the previous section at each sewing station. The use of this stitch is crucial, for it provides the necessary linking of section to section, which promotes the harmonious flow of the text when opened. One might reasonably postulate that the linked herringbone stitch is the direct descendant in the Western European tradition of bandless sewing, since it combines the section to section linkage of bandless sewing with the support and alternative board attachment possible with supported sewing.

The use of the herringbone link stitch with the proper choice of sewing thread usually produces a well-wrapped sewing support without the need for additional wraps between sections. This is also usually observed in early books, another component of the heavy-thread, compact-spine system.¹¹ (See Diagram 5)

Diagram 5**Herringbone Link Stitch**

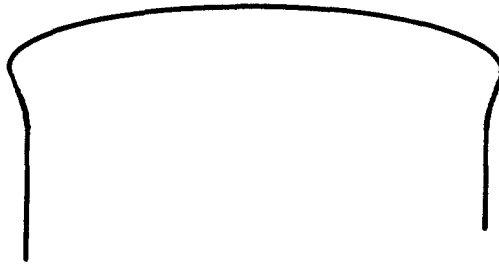
In summary, the sewing structure consists of double supports, constructed of hand-spun sewing thread, with reinforced kettle stations, normally sewn all-along with a herringbone link stitch. One additional feature is the reinforcement of the sewing of the end sections with double thread by passing the sewing through them twice. The sewing of the endbands, technically also part of the sewing structure, follows the spine shaping operations.

Spine Shaping and Lining

The shape of the spine is controlled by the degree and amount of swelling after sewing. Although it is difficult to characterize an ideal shape, the more highly compacted spine resulting from this sewing process promotes a spine shape with a very moderate amount of round. In addition, much of the shape of the spine is induced by the board attachment process. However, the spine is shaped initially in a backing press, exerting only a modicum of pressure on the textblock. This is enough to produce a slight round and a very gentle flair at the shoulders. A folder is used to help form the

round and create the flair at the shoulders; no hammering is necessary. (See Diagram 6)

Diagram 6



Spine Shape

The spine is set with a very thin layer of starch paste applied with the fingers, and one layer of Uda Japanese paper.¹² This is the only adhesive used on the spine and may be considered optional. It is certainly never used on vellum textblocks. When used, the Uda lining extends over the shoulder and is adhered to the Tyvek of the endsection's reinforcing guard, using a paste/PVA mixture on the Tyvek only. This prevents any gapping between endleaves and textblock. The Uda lining produces a very strong lining with minimal bulk, maximum flexibility, and excellent reversibility.

Endbands

The endband system is properly a feature of the sewing structure, but is more conveniently sewn following the spine-shaping process. In this model, the endband serves also to unify the sewing

structure with the covering material. The endband consists of a primary endband with back-beading sewn with linen thread and tied down in the center of each section below the kettle stitch. The endband core is made from hand-spun cord like the sewing supports. Secondary endbands with front-beading are sewn over the primary, using a decorative thread. Several alternatives to silk thread have been found which are much stronger. A good quality polyester top-stitching thread, Mettler Metrosene 30/3, Swiss-made, is readily available, as is a beautiful French cotton crochet thread, DMC Cotton Perle, #5 or #8. These are both found in most good fabric shops. Workshop-dyed linen thread still provides the strongest alternative. The final element of the endband, which links the endband to the covering material will be discussed after the covering process.

Boards

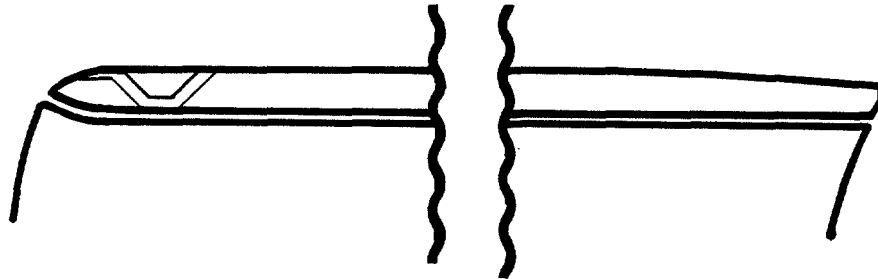
Board suitable for conservation bindings continues to be a problem. Board should be acid-free, rigid and dense. The board preferred while developing this model, an acid-free photomount board of exceptional rigidity and density, has recently been discontinued. Museum-quality matboard is acid-free, but is relatively soft, pulpy and easily dented. A new acid-free binder's board has been produced recently, which may prove useful.¹³

To achieve the necessary density and rigidity, laminates are generally superior to single-ply boards, especially when laminated with a PVA adhesive. Boards with three or four laminates appear to be more stable than those with only two, with the grains parallel in

all layers. Boards are made up to an initial thickness of at least 160 pt. caliper. This is effectively thicker than most boards associated with modern bindings, but the careful sanding and shaping of the boards accommodates many different periods and styles.

Before shaping the boards, the inner surface of the board is lined with a strong, thin, acid-free, machine-made paper to give a slight inward draw to the board. The board shaping generally follows examples of German fifteenth- and sixteenth-century bindings. There is a gradual camber on the top surface of the board beginning about two inches back from the head, tail and foreedge. The spine edge is sanded on the inner and outer edges to conform to a shape as shown in Diagram 7.

Diagram 7



Board Shape and Slotting

The inner shape of the spine edge follows the shape of the swell in the shoulder; the outer shape is more abruptly rounded. It should be evident that the board is actually thicker than the dimension caused by the swell. In order to reduce what may appear as a clumsy board edge on the head, tail and foreedge, without excessive reduction of board thickness, especially at the four corners of the

board, the inside edge of the board is sanded back at about a 45° angle to meet the edge of the text. (See Diagram 7)

Following the board shaping, the board is lined on both surfaces with a single sheet which wraps around the spine edge of the board, adhered with a starch paste. This produces a more uniform surface for covering and contributes to the overall rigidity of the board.

Board Attachment

Narrow slots are made in the boards for lacing-in using a flat woodcarvers chisel.¹⁴ The slots are made in a direct line with the sewing stations, the first about 1 cm from the back edge, the second about 1 cm from the first. The slots are made at a 45° angle. When tapped shut, the slots produce a clamping action on the cords which holds them securely without relying primarily on adhesive. (See Diagram 7)

A starch adhesive is used only as a jig. It is applied to the bottom of the channels made for the cords in order to hold the cords in place during the lacing-in process. The cords are not unraveled for lacing-in!

Before lacing-in the boards, a card "fence" (about 20 pt.) is inserted between the boards and the textblock right up to the joint, to act as a spacer. The boards are laced-in and pulled tight to the fence in an open position at about 60° to the textblock. The excess cord is cut-off flush with the top surface of the board; the slots are tapped shut from the inside, leaving the boards open until both boards have been secured. The boards are then closed

simultaneously, exerting a pull on the spine shape and producing a locking-in action of the boards at the shoulder. This is an important step if the boards are to function in a role which helps to support the book's shape, rather than act as mere appendages to the sewing supports.

Covering

The covering leathers used have been limited to the Nigerian vegetable-tanned goatskins, and alum-tawed goat and pigskins.¹⁵ The covering leather is well boarded-up prior to covering, especially for the stiffer alum-tawed pigskins. The flexibility imparted by the boarding-up process goes a long way towards eliminating the need for reducing skin thickness in order to impart flexibility. The area of the skin which covers the spine of the book is rarely reduced at all.

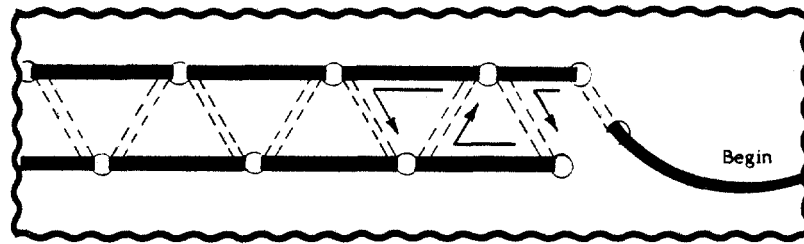
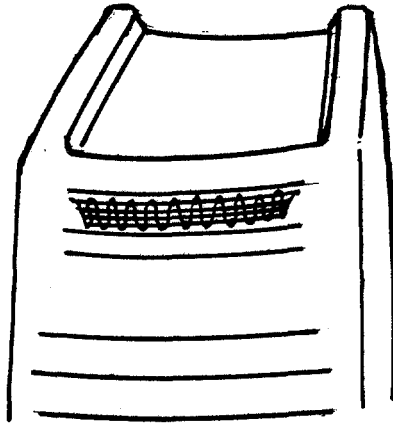
The leather is not affixed with adhesive to the spine. Greater flexibility in both the sewing structure and the covering leather results from an unpasted spine. The spine area on the leather is masked-out during the paste-up. The book is placed on the leather spine down with the boards open, the leather turned-in and the corners mitred. The book is then closed, pulling the leather tight over the spine, and tied up--with felts along the sides--in a finishing press. This moulds the leather over the bands and tight to the spine, leaving the characteristic markings of the cord across the spine.

Tacketing

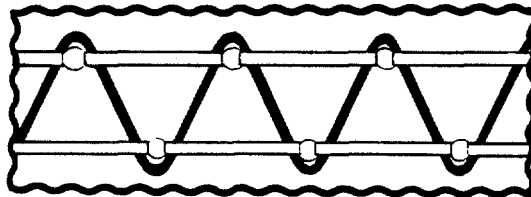
The leather is tacketed to the spine at the endbands, in a manner reminiscent of the technique described by Berthe van Regemorter on the binding of the Saint Cuthbert manuscript and on Ethiopian bindings.¹⁶ The purpose of this tacketing is to form a mechanical link between the covering leather and the sewing structure, which causes the covering leather to arch-up with the sewing structure when the book is opened. This helps to support the sewing structure, and also allows the boards to draw together as the spine arches-up, unlike hollow constructions and many inflexible tight back constructions. (See Diagram 9)

The leather is tacketed in two parallel rows of stitches; however, unlike the examples cited by van Regemorter, the stitches in each row do meet. The top row passes beneath the front beading of the secondary endband, and the bottom row pierces through the center of the adjacent section, about 3 mm below the first row. (See Diagram 8) These dimensions are governed somewhat by the weight of the thread used. Both rows are sewn simultaneously with the same thread following the pattern in Step 1, beginning and ending on the outside of the leather and leaving a long tail at each end. In Step 2, a contrasting thread is woven between the two initial rows of stitches, beginning and ending inside the book within the center of a section. In Step 3, the ends of the first thread are woven in between the initial two rows to form four woven rows, tying off the ends within the center of a section. This produces a tightly woven band of thread at the head and tail.¹⁷

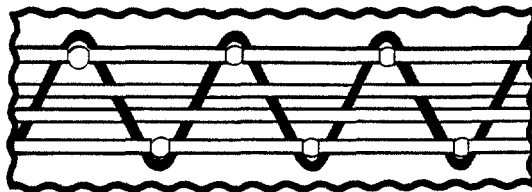
Diagram 8



Step 1



Step 2



Step 3

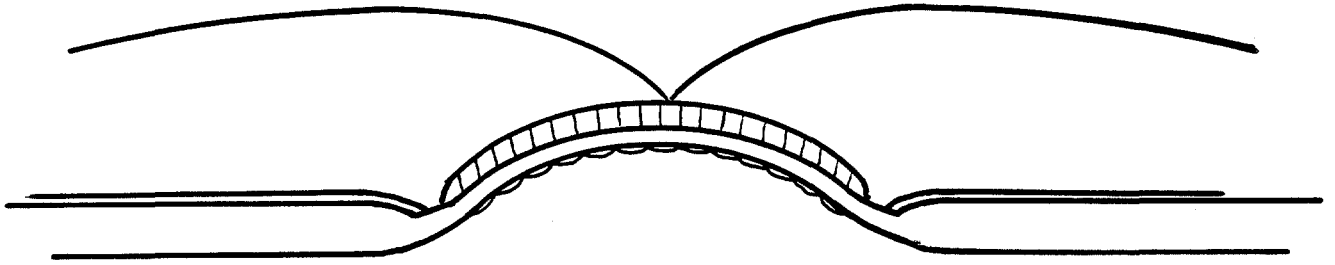
Summary

The purpose of this essay has been to define the specifications for a hard-board, laced-in binding structure suitable for

conservation binding applications. The basic elements of this binding model are a well supported, flexible, linked sewing structure, with thick, rigid, well-contoured boards, locked-in and providing support for the spine shape. The spine does not depend on adhesives or multiple linings for support, but rather utilizes the flexibility and strength of the covering leather, through a mechanical attachment at the endbands, to augment the inner structure. The covering leather functions as it originally did on the animal, to protect and sustain the internal framework. The ability to disassemble this binding without harming the text is a further advantage of this technique.

It has been my objective to develop a technique which benefits from and utilizes the best hard-board constructions of the past, and which is not limited to the occasional vellum manuscript needing conservation treatment. Furthermore, while the aesthetics of conservation bindings have not been the main focus of this essay, the aesthetic qualities of this model fulfill the objective of creating bindings which do not disrupt the appearance of an early collection of books. It is hoped that such a model will find application for a broad spectrum of books requiring conservation bindings.

Diagram 9



Book Opening and Throw Up

NOTES

¹Masako Koyano, Japanese Scroll Paintings: A Handbook of Mounting Techniques (Glenn Dale, MD: Foundation of the American Institute for Conservation, 1979), p. 9.

²Ben B. Johnson, "Oriental Mounting Techniques in the Conservation of Western Prints and Drawings," Conservation and Restoration of Pictorial Art, edited by Norman Brommelle and Perry Smith (London and Boston: Butterworths, 1976), p. 253.

³Christopher Clarkson, "Limp Vellum Binding and Its Potential as a Conservation Type Structure for the Rebinding of Early Printed Books: A Break with 19th and 20th Century Rebinding Attitudes and Practices" (Venice: International Council of Museums Committee for Conservation, 4th Triennial Meeting, 51/3, [1975]), pp. 1-15.

⁴Gary Frost, "Historical Paper Case Binding and Conservation Rebinding," The New Bookbinder 2(1982).

⁵For references to Roger Powell's technique for binding vellum manuscripts, see Anthony Cains, "Techniques of Preservation Based on Early Binding Methods and Materials," The Paper Conservator 1(1976):2; and also the essay by Roger Powell, "Case History of Repair and Rebinding of an Eighth-Century Vellum Manuscript," in Phillip Smith, New Directions in Bookbinding (New York: Van Nostrand Reinhold, 1974), pp. 174-183.

⁶Available from Kalamazoo Handmade Papers, Timothy D. Barrett, Proprietor (5947 North 25th Street, Kalamazoo, MI 49004).

⁷Tyvek is a spunbonded high density polyethylene sheet, manufactured by E. I. duPont de Nemours & Co., and available through distributors of plastics such as Transilwrap Co. (4199 "A" Oneida Street, Denver, CO 80216). For a description of the chemical and physical properties of high density polyethylene, see Modern Plastics Encyclopedia 59(1982-83), p. 79.

⁸Barbour's Linen Bookbinders Thread is manufactured by Barbour Threads, Ltd. (Hilden, Lisburn, Co. Antrim BT27 4RR, Northern Ireland).

⁹The ropemaking definitions are found in the glossary of George Lawrie, The Practical Ropemaker (Belfast: H. R. Carter Publications, Ltd., 1948), pp. 105-109.

¹⁰Personal communication with Jesse Munn, Rare Book Conservator, (Restoration Office, Library of Congress). Jesse Munn visited Barbour in March, 1982, and reported that Barbour's Satin Finish thread is slightly waxed with a proprietary formula. An

unwaxed "soft" finish thread is also manufactured by Barbour which may offer the conservator more control and choice in the waxing of thread.

¹¹A good description and diagram of the herringbone link stitch is found in Karl Jackel, "Alte Techniken des Buchbinderhandwerks in der modernen Schriftgutrestaurierung, 1: Das Heften," Bibliotheksforum Bayern 2/3(1974):257-258.

¹²Uda Light and Uda Heavy are available from Aiko's (714 Wabash Avenue, Chicago, IL 60611). The Uda papers make excellent spine linings because of their outstanding physical and chemical characteristics (surface pH between 7.0 and 8.0). From Sukey Hughes, Washi: The World of Japanese Paper (Tokyo and New York: Kodansha International, 1978), p. 193: "Uda-gami today is a kozo paper containing some powdered white clay. It is durable and does not shrink or expand significantly; the addition of the clay makes the paper hang well without curling up at the bottom and so is an excellent base for hanging scrolls as well as screens, fusuma, and sometimes shoji."

¹³This board is "Archivart Supreme BB-100," a buffered, acid-free board of 100 pt. caliper, available from Process Materials Corporation (301 Veterans Boulevard, Rutherford, NJ 07070).

¹⁴Woodcarvers chisels, unlike woodworking bench chisels which have one beveled and one flat side, have two beveled sides and are ground with two rounded heels. This feature allows for a slot which is more like an incision, which can be readily and easily closed, grabbing the full-thickness cords when tapped shut.

¹⁵Good quality Nigerian goatskins are available from P & L Leather (Reg. Office Unit 15, Gange Industrial Estate, Southwick, West Sussex, England). Alum-tawed goatskins and pigskins are produced by J. Hewit & Sons, Ltd, and are available through Bookmakers (2025 Eye Street N.W., Room 412, Washington, D.C. 20006). A quite different leather which is being explored for its potential use in conservation binding is brain-treated buckskin, produced by a skilled craftsman of Mapleton, Utah, following the technique of Native Americans.

¹⁶Berthe van Regemorter, "The Bound Codex from Its Origin to the Early Middle Ages," translated by Mary E. Greenfield, Guild of Book Workers Journal 17/1,2,3(1978-79):12-13.

¹⁷This tacketing technique was worked out by Teresa Siebach, Assistant Book Conservator (Conservation Laboratory, Harold B. Lee Library, Brigham Young University, Provo, UT).