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Board Reattachment for Circulating Collections: A Feasibility Study

Changes in bookbinding during the nineteenth century lead to many inherent problems and the eventual, even rapid failure of the binding. Joint failure, resulting in board detachment of tight joint bindings of this era, is perhaps the most noticeable result of these changes. As the industrial revolution was taking off at the end of the eighteenth century, a tremendous increase in publishing to meet the demands of an ever expanding reading public forced bookbinders to develop more rapid methods of binding. Mechanized bookbinding was still at least fifty years away, yet several shortcuts in binding, including revised methods of recessed cord sewing, board attachment, and the purchase of cheap, thin leather, were selected to increase productivity of hand binderies. These streamlining effects contributed to the eventual decline of quality hand bookbinding.

Any one of these shortcuts alone might not have caused the large numbers of joint failures, but together they have kept repairers and restorers busy. Traditionally, the only treatment for detached boards was to either completely rebind the book or to do a leather rebacking. A leather rebacking did nothing to solve the inherent problems in the binding, but simply replaced the broken leather with equally thinly pared leather and no other means of support.

The technique of reattaching boards to tight joint books has become a common feature in special collections conservation labs but is less commonly used as a repair technique in circulating collections repair operations. Yet, circulating collections contain large numbers of materials bound with tight joints. The accepted repair for these books in circulating collections tends to be recasing with a French groove. It is generally believed that this is the only repair which is strong enough to withstand circulation. Because of this practice we are losing many materials which may be unique. This paper briefly looks at the development of board reattachment techniques since the 1960's and closely examines the methods of board reattachment developed by Anthony Cains of Trinity College Dublin, Don Etherington, and David Brock. Tests indicate that carefully selected tight joint materials repaired using a board reattachment method are strong enough to survive the rigors of circulating collections.

Board reattachment is a stable, minimally invasive, relatively fast technique that can be applied to circulating collections. When used appropriately, it can be a valuable addition to treatment options in circulating collections to save time and money, increase production, and help maintain bibliographic integrity in a rapidly disappearing binding style: tight joint books.

CAROLYN HORTON'S BOARD REATTACHMENT

In the 1960's at the Grolier Club Library, Carolyn Horton developed a method of reattaching boards without doing a full leather rebacking.[1] A piece of colored cloth was used to make a hinge which was adhered on the inside of the covers. The procedure consisted of placing a bead of PVA along the gutter of the first two or three leaves to give a strong base for the cloth. The cloth was then adhered with PVA to the shoulder and folded over to be exactly level with the same shoulder. The pastedown was lifted on the board and a small area of board removed to accommodate the cloth thickness. Then the cloth was adhered to the board and the board positioned on the book. Finally, PVA was worked into the gap between the board and the fold of the cloth to prevent the board from moving about. The final product would have looked as such (fig. 1).

The cloth hinge marked a departure from the practice of conservation as restoration to conservation as stabilization. The problem was no longer being solved by repeating the structure with its inherent flaws, but was being repaired with strong, stable materials and minimal intervention which allowed for a faster, yet long lasting repair. The inherent drawback of this method is the stiffness of the cloth and PVA which presented a breaking edge at the shoulder and additionally in small volumes a

stiffness in their opening. This method, although not widely used anymore for these reasons, has been the basis for many other treatments that have been developed.

BOARD SLOTTING

In the 1970's, at the Library of Congress, Christopher Clarkson began experimenting with his board slotting technique. Clarkson was concerned with the time and invasiveness of leather rebacking, especially on very slick, gilded decorative bindings with doublures. He wanted to develop a method to reattach boards without affecting the look of the binding inside or out. By attaching a linen hinge to the spine and then slotting it into a notch sawed into the board, a nearly invisible repair could be made. The procedure of board slotting can be summarized as follows:[2]

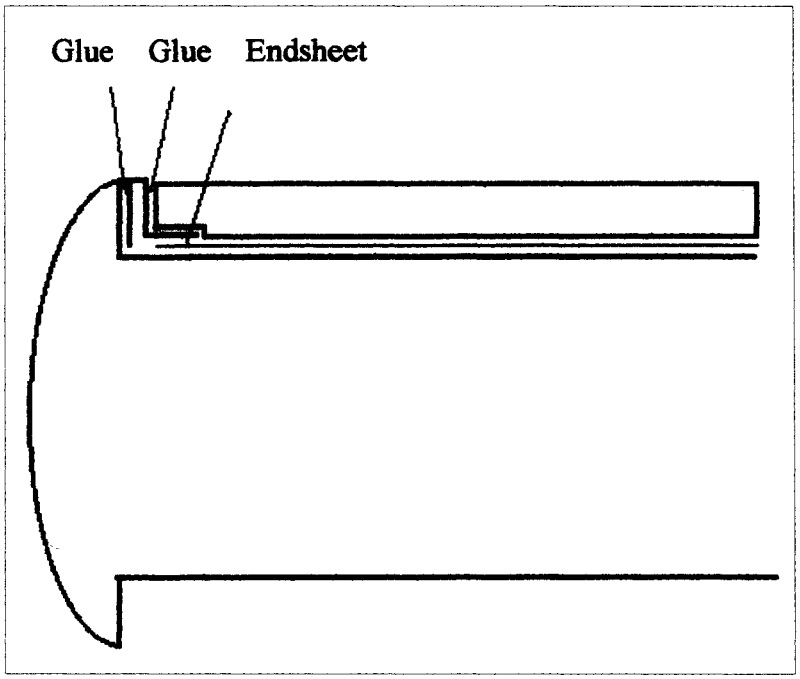

Fig. 1.

1. Lift spine leather.
2. Attach linen hinge to spine with paste and stiffen the tongue with paste or glue.
3. Select a saw blade to correspond to the thickness of repair cloth and the proper depth for the board.
4. Place the book board into a holding jig and create the diagonal slot along the board leaving approximately 1/4 inch at head and tail.
5. Cut the stiffened linen tongue to the depth of the slot and round its corners to correspond to the rounded corners created by both ends of the saw cut.
6. Place a pressing tin up against the shoulder of the book.
7. Open the slot and spread paste on both sides.
8. Squeeze out any excess paste.
9. Paste up both sides of the tongue.
10. Insert tongue into slot.
11. Set board and press.

In order to proceed with this technique, the board must be thick enough and strong enough to withstand the sawing. Specialized equipment and extensively trained personnel are required to execute this rather involved treatment. These factors tend to make this a less than attractive procedure for circulating collections.

JOINT TACKETTING

A more utilitarian exploration into board reattachment did not begin until the 1980's. In 1980, the Long Room Project at Trinity College Dublin was begun by Anthony Cains. One of the treatments in this ongoing project was the reattaching of book boards using a method devised by Cains. Joint tacketing was developed as a temporary measure to allow the binding to function normally until more in-depth conservation treatments could be performed. The procedure may be summarized as follows:[3]

1. If the book has a hollow back, the cover spine piece is easily removed; on a tight back, the spine piece is lifted, the spine cleaned and relined.
2. If the book has a tight back that cannot be easily removed, or the leather is too degraded to lift, make "L" shaped cuts at each point where the tacket will be and lift to make small doors for the thread to sit.
3. Tip a strip of Japanese tissue to the shoulder.
4. Make holes through the Japanese tissue and shoulder at a 45 degree angle.
5. Insert a loop of linen thread through the holes from the shoulder side, bring loose ends through loop and tighten.
6. Mark boards for corresponding holes. Make two holes in the board at each tacket point. Begin in the center of the board thickness and go through to the inside of the board at an angle. The two holes should begin in the same spot and angle away from each other to end approximately one quarter inch apart.
7. Lace one end of the thread through each hole, tie with a square knot with the board open approximately 120 degrees.
8. Adhere Japanese tissue hinge over the tacket.

This method is now beginning to be used widely in the conservation of both special collections and circulat-

ing collections for tight joint books. One requirement is a shoulder substantial and strong enough to sew through. Another is that the board must also be stable and thick enough to withstand the drilling or punching of the holes and subsequent use after being sewn to the text block. It is a quick and relatively easy procedure to learn and master and, if the book is appropriately selected, a strong repair is the result. Because of this, it is a welcome addition to circulating collections.

DON ETHERINGTON'S JAPANESE TISSUE HINGE

Board reattachment has progressed steadily since the 1980's. Along with joint tacketing, other methods have come into use in special collections. Two separate methods using Japanese tissue have been developed by Don Etherington and David Brock. Most commonly used is the Etherington method, summarized below.[4]

1. Adhere a hinge of Japanese paper so that one torn edge is at the tip of the shoulder and the rest of the hinge extends onto the textblock.
2. Select a solid dyed Japanese paper to match the leather and tear two strips one half inch longer than the boards and of a width approximately one quarter inch.
3. If the leather is degraded, consolidate.
4. Position the board on the book and weight. Adhere the Japanese tissue across the joint.
5. Let the outer hinge dry then turn in head and tail.
6. Open the cover and adhere the inner Japanese tissue hinge. Let dry open.
7. Coat the outer Japanese tissue hinge with a microcrystaline wax to give a more leathery look.

Etherington describes his method thus, "The rationale for repairing bound books broken just at the joints with a strong Japanese paper instead of a pared strip of leather comes down to one word, strength. The application of two strips of Japanese paper, one outside and one inside, gives a very strong board attachment to the spine and is a method of minimal intervention to the original binding."[5] This technique is best used on tight joint books where the spine is intact, the board covering in good condition and the size of the book does not exceed the standard octavo dimensions. In an informal survey of conservation labs doing board reattachments, this was found to be by far and away the most popular technique for octavo, or smaller sized books.

DAVID BROCK'S JAPANESE TISSUE METHOD

Also in use, however, is the Brock method. Brock presented this technique in an informal session at AIC in 1991 and is summarized below.

1. Tear a strip of medium weight dyed Japanese tissue.
2. Tip the hinge to the shoulder so that the torn edge is at the top of the shoulder.
3. Make a series of paried holes along the shoulder at a 45 degree angle.
4. Using a thin linen thread, starting on the shoulder side, sew through the holes all along going in and out.
5. Fold the Japanese tissue over on itself and run a bead of adhesive to adhere it to the shoulder.
6. Cut the loops of thread on the spine, fray out and adhere.
7. Lift the covering material on the board. Set the board in place and weight.
8. Adhere Japanese tissue to the lifted area on board. Allow to dry.
9. Open the board. Tear a strip of Japanese tissue to fit in the exposed hinge and adhere.

Although this treatment is not complex, it must be carefully done in order to get a solid repair. When done by a less experienced person, the board has a tendency to become unfixed over time because the pasted fold in the tissue may not have been thoroughly adhered to the board edge.

TESTING

For the purposes of this research, three board reattachment techniques were tested: Cains' joint tacketing, Etherington's Japanese tissue method and Brock's Japanese tissue method. Joint tacketing and Etherington's Japanese tissue method were selected because they appear to be the more commonly used techniques in conservation labs associated with special collections and circulating collections. Brock's method was chosen because its technique appears to be a combination of the methods of joint tacketing and Etherington's Japanese tissue.

Six tight joint books were selected from an assortment of discarded collection material. Two books with detached boards were treated for each method. All six books differed in weight, dimension, age, condition and materials. When choosing the two books for each method, books of similar dimension but different weight and material (leather or cloth) were selected. Each set of two also had one book with a tight spine and one with a hollow spine. The use of contrasting books allowed for an assessment of each method and the considerations for its use since all six came from a circulation collection. Also for comparison, the front boards were adhered with PVA while the back boards were adhered with paste. This was done to see if, in testing, it could be determined whether the adhesive played a significant role in the strength of the repair.

Since the focus of this paper is board reattachment for circulating collections, aesthetics were not the first priority.

Dyed Japanese tissue was used, but such niceties as lifting little doors in the tight leather spines and using the microcrystaline wax to create a more compatible look, were not done. Otherwise, the techniques as summarized above were followed to repair the books selected.

The six repaired books were sent to be tested at Information Conservation, Inc.'s Conservation Division in Brown Summit, NC. It is hoped by assessing the resulting condition of these books, a method of board reattachment specific to circulating collections can start to be developed.

The Universal Book Tester (UBT) designed by the Barrow Laboratories was used to test the books and monitoring was done by Harry Campbell, Chief Conservator at ICI. The UBT, as described by "Barrow Testing Lab" in *The Title Page* number 5, 1992, is designed to closely simulate the treatment of the book in real life. The book to be tested in the UBT is placed in the bottom of a slanted tray lined with a metal fabric screen. This tray can be rotated at different speeds and inclined at different angles. As the tray rotates, the book receives regulated impact stress on all four sides, four drops (one for each side) equaling one rotation, causing stress at the hinges as the volume drops on its boards. As a result of the size of the tray, smaller books are dropped at a greater distance than large books. The actions of the UBT simulates those stresses on a book which receives heavy use would normally be exposed to in a circulating collection: pulling the headcap, sliding off the shelf, dropping onto a book truck or into box, and sliding across a table or down a book drop. Through such use, a book would show resulting abrasions at the shoulder, spine and cover, failure of the internal hinge or joint.

The selection of the UBT came after a search of various mechanized testing apparatus. Although not ideal for the strict testing of the joint of the reattached board it gave the best overall simulation of a book in a circulating collection. Perhaps a better test would be a mechanism which would open and close the cover until failure. Although the UBT simulates a book receiving heavy use, the results of this test may carefully be used to estimate the wear given to a medium or low use book. The longer the particular book and related reattachment method lasted in the UBT, it is possible the technique would better hold up to medium or low use while in circulation.

An in-depth comparison of all board reattachment methods cannot be made as a result of this testing. To compare each method with the other, equality in the soundness and physical characteristics of the books must be present. The best option would be to find a large edition of books, all of the same title from one edition and the same collection. Within such a set, the physical characteristics will be equal, and if the books are from the same collection, the condition would be very similar.

RESULTS

Overall, the books that held up the best to testing were those whose boards were reattached with the Etherington Japanese tissue method and by Cains' joint tacketing. Although all three methods had some problems, they appear to have come from the poor selection of books for testing rather than a direct failure of the method.

In assessing each method, new considerations specific to circulating collection material cropped up. The problem that appeared with the Etherington method when put through the UBT was not so much in the breakage of the hinge, but in the separation of the tipped-on endsheet to the text block resulting in the text block falling out of the case with the boards still in tact. The text block fell out of both the tight back and hollow test books since, in essence after the repair, the book had a case binding with the text block held in with Japanese tissue rather than a linen hinge. A review of the history of use and a reinforcement of the endsheet to text block attachment is necessary for those books to be repaired in this manner for circulating collections. No conclusions can be made on paste versus PVA since only one joint broke and the tissue did not release from either book.

When considering the results of the testing done on the books that had been repaired using joint tacketing, it was found that it is important to look at the shoulder and the board. The book must have a sufficient shoulder or, if the shoulder is small, ensure that the paper is strong enough to prevent the thread from pulling though in use. In the two books tested, one book had a small shoulder of weak paper and the front cover pulled through the shoulder after 10 seconds, or only 3 drops, in the UBT. The second book, with a substantial shoulder and very stable materials, lasted 55 minutes, or 1100 drops, in the UBT, at which point the thread broke.

The method that does not appear to be viable for circulating collections is David Brock's. The longest either book lasted in the UBT was six minutes. Not only did the tissue tear but also both books showed a failure in the thread, either broken or pulled through the shoulder. The problem area appears to be in the adhesion of the Japanese tissue to itself in the shoulder. In circulation, this area will be the first to come loose, causing the board to sit improperly on the book and be more vulnerable to damage or loss.

CONCLUSION

For octavo or smaller books, the method that appears to work the best is Etherington's Japanese tissue method. It is a repair that will not create much bulk in a smaller volume, yet it will be strong enough to withstand low to moderate use if the volume is properly selected. The covering material should be stable and the endsheet to text block

attachment should be sound before using this method in a circulating collection. If the material is not stable, for example if the leather is red rotting, the repair will not be stable enough to withstand circulation. Also, if the end sheet to text block attachment is weak or not reinforced, the strength of the repair will cause failure to the attachment in circulation. From the volumes tested, the weight of the book does not exert as great an influence on the stability of the repair as would be expected. The larger, heavier volume actually held up better under testing than the lighter one. Although not the original intention of the repair, this method appears to function quite well on tight joint cloth bindings as well as leather.

For larger books in a circulating collection, if the shoulder is of sufficient size and strength, Cains' joint tacketing is the preferred method. Smaller books with a minimal shoulder do not hold up under testing as well as a book which has a sufficient shoulder through which to sew. Not only shoulder size but also the stability of the shoulder should be considered in all books. If the paper of the text block is weak or brittle, the strength and relative sharpness of the thread used will cause the repair to tear through the shoulder. Finally, the condition of the board must be stable enough to withstand the repair. If the boards of any volume being considered for this repair are brittle or very thin, another method of repair should be considered. When preparing to do this repair, consider the thickness of the thread as well. For quarto or larger sized books, a heavier thread would be appropriate to give extra strength.

The Brock tissue method does not appear viable for circulating collections due to the apparent rapid failure of the adhered fold and the vulnerability of the board resulting from its failure.

The development of a board reattachment method specifically for circulating collections should be possible with additional testing. The tests should be designed to compare the three methods to each other and to determine their limitations. Any method developed would be beneficial for the field to promote less invasive treatments in collections maintenance and to preserve tight joint bindings for future researchers.

NOTES

1. Paul Banks, conversation, Spring 1996.

2. Christopher Clarkson, "Board Slotting-A New Technique for Re-attaching Bookboards," in *The Conference Papers Manchester* 1992 (London: The Institute for Paper Conservation, 1992), 158–164.

3. Robert Espinosa and Pamela Barrios, "Joint Tacketing: A Method of Board Reattachment," in *The Book and Paper Group Annual* 10 (Washington D.C.: Book and Paper Group, 1991), 78–83.

4. Don Etherington, "Japanese Paper Hinge Repair," *The Abbey Newsletter* 19, no. 3 (1995), 48–9.

5. Ibid.

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APPENDICES

A - Book Specifications for Board Reattachment Testing

TITLE	MATERIAL	LEN(cm)	WID(cm)	WT(g)	NOTES	METHOD
Annual Rpt of the Pres and Treas	buckram	23	14.9	1676.6	thick!, hollow spine	Brock
Josephus' Works	leather	23	15.1	882.5	part spine missing	Brock
Derecho Romano	leather	22	14.4	392.3	hollow spine	Etherington
University of Chicago Record 4	cloth	23.6	19.4	979.3	unfilled cloth	Etherington
Gould's Ovid	leather	19	12	276.5	min shoul, part spine miss	Joint Tacket
Census of India 1891	buckram	33.1	21.8	1931.1	library binding	Joint Tacket

TITLE: India Census 1891
MATERIAL: Buckram
LENGTH: 33.1 cm WIDTH: 21.8 cm WEIGHT: 1931.1 g
METHOD OF REATTACHMENT: Joint Tacketing
NUMBER OF ROTATIONS TO FAILURE: 1100 rotations (55 minutes)
FAILURE TO X FRONT BOARD _____BACK BOARD
FAILURE TO _____HEAD _____TAIL _____CENTER X OVERALL

IF JOINT TACKETED, FAILURE CAUSED BY:
- X THREAD BREAKAGE (55 minutes)
- _____THREAD TEARING THROUGH BOARD
- _____THREAD TEARING THROUGH SHOULDER
- X INTERIOR JAPANESE TISSUE TEAR (5 minutes)

IF ETHERINGTON JAPANESE TISSUE, FAILURE CAUSED BY:
- _____INNER TISSUE HINGE TEAR
  - _____HEAD _____TAIL _____OVERALL
- _____OUTER TISSUE HINGE TEAR
  - _____HEAD _____TAIL _____OVERALL
- _____INNER TISSUE PULLED AWAY
  - _____BOARD _____FLY LEAF
- _____OUTER TISSUE PULLED AWAY
  - _____BOARD _____SPINE

IF BROCK JAPANESE TISSUE METHOD, FAILURE CAUSED BY:
- _____TISSUE HINGE TEAR
  - _____HEAD _____TAIL _____OVERALL
  - _____OUTER BOARD _____INNER HINGE
- _____THREAD FAILURE
  - _____BROKEN _____TORN THROUGH SHOULDER

CONDITION OF BOTH JOINTS UPON FAILURE:

ADDITIONAL COMMENTS:
Both inner hinges split after 5 minutes (100 rotations)
Alternated back and front sides down in tray

B - Results of UBT Testing

TITLE: Gould's Ovid
MATERIAL: Leather
LENGTH: 19 cm WIDTH: 12 cm WEIGHT: 276.5 g
METHOD OF REATTACHMENT: Joint Tacketing
NUMBER OF ROTATIONS TO FAILURE: 3 rotations (about 10 seconds)
FAILURE TO _____X_____FRONT BOARD _____BACK BOARD
FAILURE TO _____HEAD _____TAIL _____CENTER ___X___OVERALL

IF JOINT TACKETED, FAILURE CAUSED BY:
_____THREAD BREAKAGE
_____THREAD TEARING THROUGH BOARD
___X___THREAD TEARING THROUGH SHOULDER
_____INTERIOR JAPANESE TISSUE TEAR

IF ETHERINGTON JAPANESE TISSUE, FAILURE CAUSED BY:
_____INNER TISSUE HINGE TEAR
_____HEAD _____TAIL _____OVERALL
_____OUTER TISSUE HINGE TEAR
_____HEAD _____TAIL _____OVERALL
_____INNER TISSUE PULLED AWAY
_____BOARD _____FLY LEAF
_____OUTER TISSUE PULLED AWAY
_____BOARD _____SPINE

IF BROCK JAPANESE TISSUE METHOD, FAILURE CAUSED BY:
_____TISSUE HINGE TEAR
_____HEAD _____TAIL _____OVERALL
_____OUTER BOARD _____INNER HINGE
_____THREAD FAILURE
_____BROKEN _____TORN THROUGH SHOULDER

CONDITION OF BOTH JOINTS UPON FAILURE:
Front: Board and several pages torn away through shoulder
Back: thread and shoulder OK, tissue hinge split wide open

ADDITIONAL COMMENTS:
- Back hinge split (almost full length of joint) prior to testing
  tissue appears to have been too tight
- Placed back side down in tray

TITLE: University of Chicago Record #4
MATERIAL: Unfilled Cloth
LENGTH: 23.6 cm WIDTH: 19.4 cm WEIGHT: 979.39 g
METHOD OF REATTACHMENT: Etherington Japanese Tissue
NUMBER OF ROTATIONS TO FAILURE: approx. 1040 rotations (about 50 minutes)
FAILURE TO _____FRONT BOARD __X__BACK BOARD
FAILURE TO _____HEAD _____TAIL _____CENTER __X__OVERALL

IF JOINT TACKETED, FAILURE CAUSED BY:
_____THREAD BREAKAGE
_____THREAD TEARING THROUGH BOARD
_____THREAD TEARING THROUGH SHOULDER
_____INTERIOR JAPANESE TISSUE TEAR

IF ETHERINGTON JAPANESE TISSUE, FAILURE CAUSED BY: (see additional comments)
_____INNER TISSUE HINGE TEAR
_____HEAD _____TAIL _____OVERALL
__X__OUTER TISSUE HINGE TEAR
_____HEAD _____TAIL __X__OVERALL (back board only)
_____INNER TISSUE PULLED AWAY
_____BOARD _____FLY LEAF
_____OUTER TISSUE PULLED AWAY
_____BOARD _____SPINE

IF BROCK JAPANESE TISSUE METHOD, FAILURE CAUSED BY:
_____TISSUE HINGE TEAR
_____HEAD _____TAIL _____OVERALL
_____OUTER BOARD _____INNER HINGE
_____THREAD FAILURE
_____BROKEN _____TORN THROUGH SHOULDER

CONDITION OF BOTH JOINTS UPON FAILURE:
Back joint completely split. Front joint OK. Both inner hinges OK

ADDITIONAL COMMENTS:
Both boards detached (prior to joint break) at flyleaf tipped to text block.
Book was backside down in UBT tray, some abrasion evident.

TITLE: Derecho Romano
MATERIAL: Leather
LENGTH: 22 cm WIDTH: 14.4 cm WEIGHT: 392.3 g
METHOD OF REATTACHMENT: Etherington Japanese Tissue
NUMBER OF ROTATIONS TO FAILURE: 700 rotations (35 minutes)
FAILURE TO _____FRONT BOARD _____BACK BOARD
FAILURE TO _____HEAD _____TAIL _____CENTER _____OVERALL

IF JOINT TACKETED, FAILURE CAUSED BY: (Joints OK - see comments)
_____THREAD BREAKAGE
_____THREAD TEARING THROUGH BOARD
_____THREAD TEARING THROUGH SHOULDER
_____INTERIOR JAPANESE TISSUE TEAR

IF ETHERINGTON JAPANESE TISSUE, FAILURE CAUSED BY:
_____INNER TISSUE HINGE TEAR
_____HEAD _____TAIL _____OVERALL
_____OUTER TISSUE HINGE TEAR
_____HEAD _____TAIL _____OVERALL
_____INNER TISSUE PULLED AWAY
_____BOARD _____FLY LEAF
_____OUTER TISSUE PULLED AWAY
_____BOARD _____SPINE

IF BROCK JAPANESE TISSUE METHOD, FAILURE CAUSED BY:
_____TISSUE HINGE TEAR
_____HEAD _____TAIL _____OVERALL
_____OUTER BOARD _____INNER HINGE
_____THREAD FAILURE
_____BROKEN _____TORN THROUGH SHOULDER

CONDITION OF BOTH JOINTS UPON FAILURE:
Joints OK

ADDITIONAL COMMENTS:
After 20 minutes (400 rotations) text blocks beginning to split and pulling away from spine lining. After 35 minutes (700 rotations) text block completely split away between 1st and last signatures.
Book placed back side down in tray.

TITLE: Annual Reports 1907-09
MATERIAL: Buckram
LENGTH: 23 cm WIDTH: 14.9 cm WEIGHT: 1676.6 g
METHOD OF REATTACHMENT: Brock Japanese Tissue
NUMBER OF ROTATIONS TO FAILURE: 20 rotations (1 minute)
FAILURE TO __X__FRONT BOARD __X__BACK BOARD
FAILURE TO _____HEAD _____TAIL _____CENTER __X__OVERALL

IF JOINT TACKETED, FAILURE CAUSED BY:
_____THREAD BREAKAGE
_____THREAD TEARING THROUGH BOARD
_____THREAD TEARING THROUGH SHOULDER
_____INTERIOR JAPANESE TISSUE TEAR

IF ETHERINGTON JAPANESE TISSUE, FAILURE CAUSED BY:
_____INNER TISSUE HINGE TEAR
_____HEAD _____TAIL _____OVERALL
_____OUTER TISSUE HINGE TEAR
_____HEAD _____TAIL _____OVERALL
_____INNER TISSUE PULLED AWAY
_____BOARD _____FLY LEAF
_____OUTER TISSUE PULLED AWAY
_____BOARD _____SPINE

IF BROCK JAPANESE TISSUE METHOD, FAILURE CAUSED BY:
__X__TISSUE HINGE TEAR (both boards)
_____HEAD _____TAIL __X__OVERALL
_____OUTER BOARD _____INNER HINGE
__X__THREAD FAILURE (back board)
__X__BROKEN _____TORN THROUGH SHOULDER

CONDITION OF BOTH JOINTS UPON FAILURE:
Back board torn away - thread failed; inner hinge torn; endleaf torn; separation where endleaves are tipped to text - front and back

ADDITIONAL COMMENTS:
Placed front side down in tray

TITLE: Josephus' Works vol. 1
MATERIAL: Leather
LENGTH: 23 cm WIDTH: 15.1 cm WEIGHT: 882.5 g
METHOD OF REATTACHMENT: Brock Japanese Tissue
NUMBER OF ROTATIONS TO FAILURE: 20 rotations (1 minute) boards barely held on by thread
120 rotations (6 minutes) front board off
FAILURE TO __X__FRONT BOARD __X__BACK BOARD
FAILURE TO _____HEAD _____TAIL _____CENTER __X__OVERALL

IF JOINT TACKETED, FAILURE CAUSED BY:
_____THREAD BREAKAGE
_____THREAD TEARING THROUGH BOARD
_____THREAD TEARING THROUGH SHOULDER
_____INTERIOR JAPANESE TISSUE TEAR

IF ETHERINGTON JAPANESE TISSUE, FAILURE CAUSED BY:
_____INNER TISSUE HINGE TEAR
_____HEAD _____TAIL _____OVERALL
_____OUTER TISSUE HINGE TEAR
_____HEAD _____TAIL _____OVERALL
_____INNER TISSUE PULLED AWAY
_____BOARD _____FLY LEAF
_____OUTER TISSUE PULLED AWAY
_____BOARD _____SPINE

IF BROCK JAPANESE TISSUE METHOD, FAILURE CAUSED BY:
_____TISSUE HINGE TEAR
_____HEAD _____TAIL _____OVERALL
_____OUTER BOARD _____INNER HINGE
__X__THREAD FAILURE (front)
__X__BROKEN __X__TORN THROUGH SHOULDER

CONDITION OF BOTH JOINTS UPON FAILURE:
Both joints separated between fly leaves and text block

ADDITIONAL COMMENTS:
Prior to testing, large gaps between front fly and half-title. Same at back. Almost complete separation.
Placed back side down in tray.