A Survey of Hinges

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From a technical point of view, books are a collection of flat elements (paper, board, etc) joined together into a block. This block is a simple compact entity when closed, but a rather complex mechanical object when handled. Two main motions can be observed within a functioning book: firstly there is the obvious rotational movement when opening a cover or turning a page. As the reader makes his way through the book, a second 'flexing' motion occurs as the text-block arches up and away from the spine of the case [Fig. 1].

In this article I will focus on the rotational movements only and concentrate in particular on hinges, as they are key to making this possible. We will look at how they function and what their applications may be in bookbinding and box-making. This will take the form of a survey (and not a scientific study), giving an overview of the surprising diversity of structures that I came across in both hand- and machine-bookbinding, and will embrace both the most mundane as well as less well known solutions. Some of my examples are purely technical whilst others may be considered as works of art in their own right by their sheer elegance, sophistication and expressive potential.

I differentiated between two main categories of rotating hinges: group 'A' relies on nothing else than the material itself, whilst group 'B' makes use of additional external features, such as the covering material, threads, magnets, and so on.

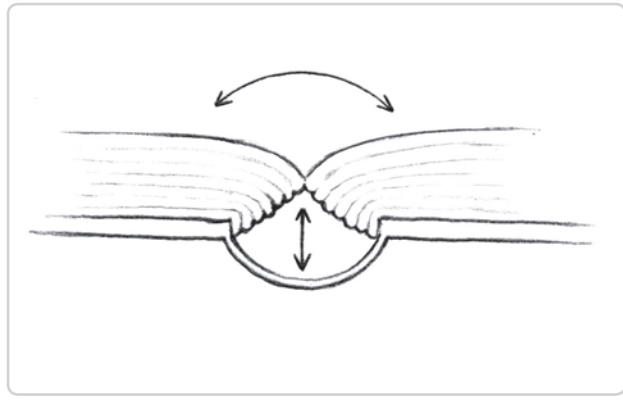

Fig. 1. Rotational and opposing flexing motion.

Fig. 2. **Imaginaire Landschappen** by Emily Van Olden.

Fig. 3. Kaleidoscope structure by Gabriel Zegna.

GROUP A: USING THE MATERIAL ITSELF

a1. The drape

Before we go into actual hinges, I thought it would be worthwhile to talk about paper flexibility, which is in itself a form of hinging. When applied to books this motion is called 'drape' and depends both on the paper's weight, its flexibility, and the size of the book. A wide page will drape better than a narrower fold of the same paper. In Fig. 2 you can see a contemporary Japanese-style binding on a work by the Dutch artist Emily Van Olden, bound by myself. The leaves are 60gsm and display a satisfying drape, which would probably not be the case with a much narrower book (page width here: 220mm).

a2: The fold

The fold in itself is at the very heart of any binding (such as sections etc.), but I thought I'd show you something else to illustrate the power of these. In Fig. 3 every fold is effectively a hinge as the structure is designed to turn on itself indefinitely.

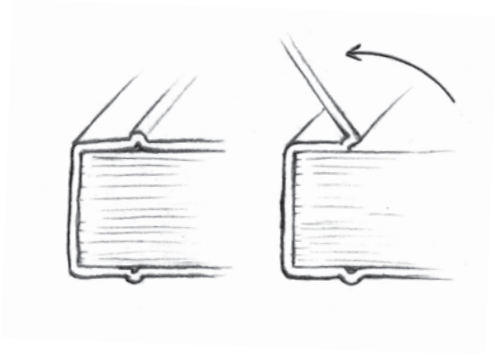

Fig. 4. Scored hinge on a brochure.

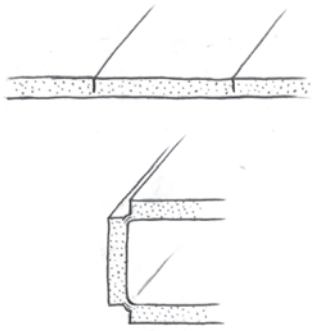

Fig. 5. Release cuts in cardboard.

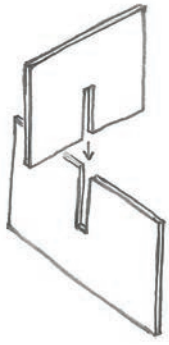

Fig. 7. Interlocking panels.

Fig. 6. **Martell books** designed by Jake Noakes, produced by Booxs (NL).

a3. The scored groove

Any paper heavier than about 200gsm is not happy to be folded and likely to show unaesthetic creases or cracks next to the fold. A scored line (as with a bone-folder for example) establishes a 'groove' that avoids the mentioned problems and facilitates a neat linear point of movement [Fig. 4].

a4. The release cut

This method is routinely used in print finishing and industrial box-making as well as in binderies that aim for a cost-efficient outcome [Fig. 5]. It consists of cutting cardboard halfway through (or more), in order to create a hinge. It can all be done in one go when using cutting dies or one by one when done by hand. When folded, the cuts open up to allow for the movement, this results in a slightly rounded look on the outer edge, which might not be to everyone's liking.

Another and perhaps a more interesting example of the cut-to-release process can nowadays be achieved with the help of laser cutters. The stunning example of *Martell books* shows laser-cut plywood [Fig. 6] where a pattern of slots has been cut into the otherwise rigid spine. As some points remain intact these release-cuts create a complex hinge.

a5. Interlocking panels

Another way of hinging two pieces of paper is to interlock them [Fig. 7]. This is common practice in the world of pop-ups as it is believed to be more durable than folding, as it avoids the issue of 'paper fatigue'. The pop-up book *Boven Kamers* by Moon Brouwer makes spectacular use of this very simple principle, and one which I had the pleasure of binding [Fig. 8].

Fig. 8. Pop-up in **Boven Kamers** by Moon Brouwer.

GROUP B: USING EXTERNAL FEATURES

b1. The covering material

Using additional external material is the most common way to create hinges in the world of books and boxes. These can essentially be divided into two sub-groups: the tight and the wide joint.

The tight hinge: In Fig. 9 you can see four examples that are mainly used in box-making. They are from left to right: using regular boards (a), milled boards (b), staggered boards (c), and bevelled boards (d). All of these methods have their advantages and drawbacks: (a) and (b) are the fastest techniques, though both have a serious drawback, as the spine pieces offer no physical structural support, so the boards have a tendency to sink in over time. The milling process in (b) requires CNC routing equipment and is therefore a more industrial method. In comparison, examples (c) and (d) take a little more time to make, but have the considerable advantage that the spines support the boards. A traditional book structure, whether cased in or worked directly on the book (i.e. with laced-on boards or in other ways), is basically a variation of Fig. 9d. It is interesting to notice that the hinge is not an abstract geometric line, but indeed requires a physical gap, as one can appreciate in Fig. 10, when considering the distance between the board and the shoulder.

The wide hinge: The simplest case binding style is the one with a flat spine (flat-backs) [Fig. 11]. This is essentially a variation from diagram Fig. 9a, though with much wider gaps. These are shaped into so-called French grooves, which serve two purposes: they enable the board to swing open but also allow for the spine area to 'shorten', when the text-block moves up and away from the spine of the case when being read.

b2. Woven hinges

We all know this hinge from a toy called the Jacob's Ladder, the 'magic wallet', or Japanese screens. A flat band (or ribbon, thread, etc.) laces around lined-up elements in an alternating weave. The construction is capable of a 360° rotation whilst the elements stay firmly connected [Figs 12, 13 & 14].

The woven hinge has interesting potential for book-binding and box-making. Besides the extreme and fluid rotational movement, an added interest lies in the fact that the boards can be covered separately, which results

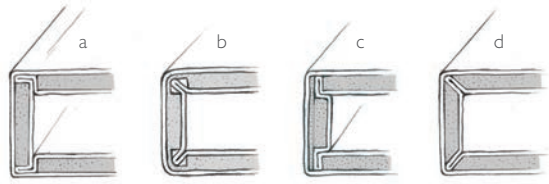

Fig. 9. Four ways to work a tight hinge.

Fig. 10. The 'narrow' hinge of a fine binding.

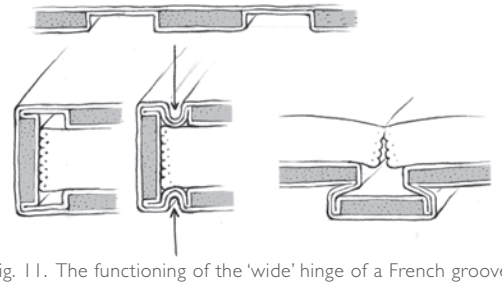

Fig. 11. The functioning of the 'wide' hinge of a French groove.

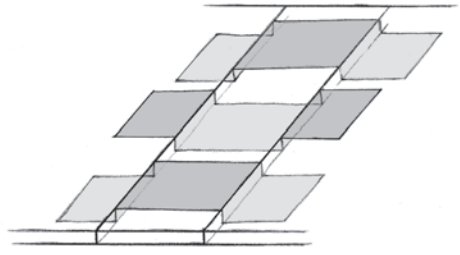

Fig. 12. Interlaced weave.

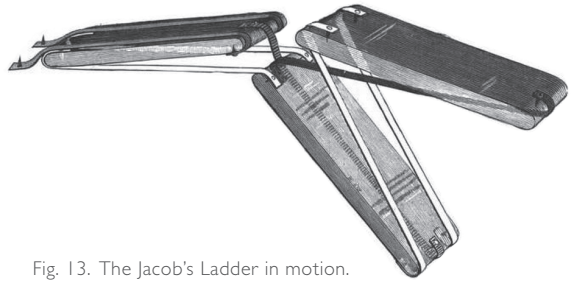

Fig. 13. The Jacob's Ladder in motion.

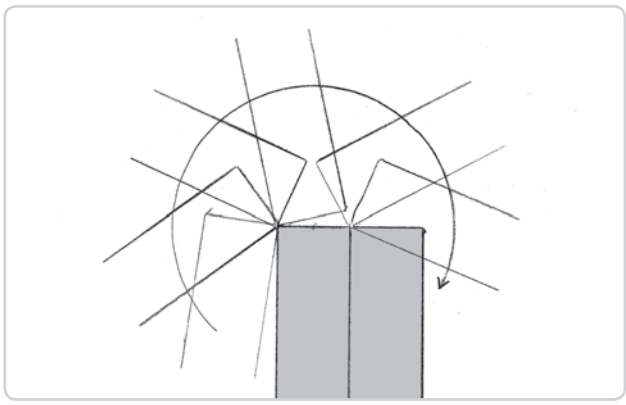

Fig. 14. The full 360° swing.

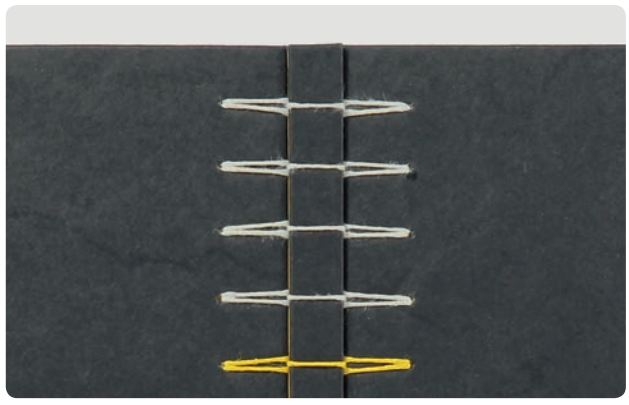

Fig. 15. Classic crisscross structure by Anne Goy.

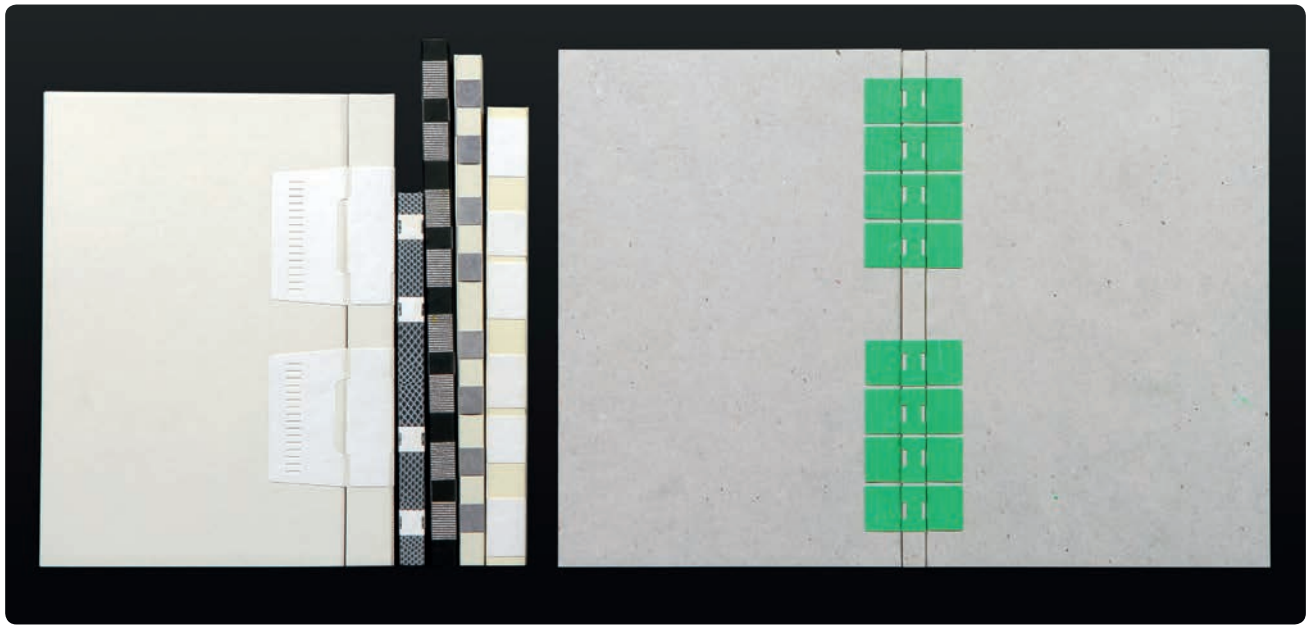

Fig. 16. Crisscross binding with Tyvek hinges by Anne Goy.

in visually crisp joints. Anne Goy was a pioneer when starting to explore the structure's possibilities in the 1980s. She developed a style which was known for many years as the 'Secret Belgian Binding', before she renamed it 'Crisscross Binding' in 2010 [Fig. 15]. A little less well known are her latest developments in this area, where she uses Tyvek elements in a variety of shapes, far from the basic principle as illustrated above [Fig. 16].

b3. Sewn hinges

The first guess when looking at the book in Fig. 17 would probably be that the red dots are the sewing supports, laced through the boards? They are not. What you can see is the visible evidence of a secondary sewing that is totally independent from the text-block. It runs vertically and functions as an articulating hinge between the spine and the boards [Fig. 18]. If one takes a (very) close look you will see two threads crossing each other in each hole. However from a distance they just look like red dots.

b4. Rod hinges

A rod hinge follows the same principle as that of a door hinge: all you need is a rod that serves as a point of rotation for attached elements. There are numerous historical examples that use this simple principle, most notably perhaps the 18th-century silver bindings [Fig. 19]. However, here the text-blocks are sewn in the

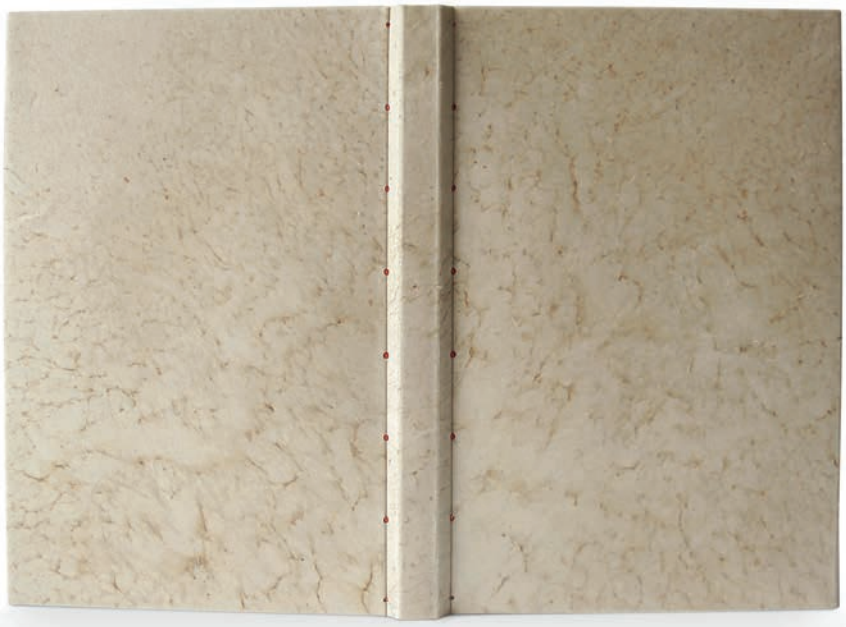

Fig. 17. **Storia Romana**, vellum binding with sewn hinges. Bound by Benjamin Elbel.

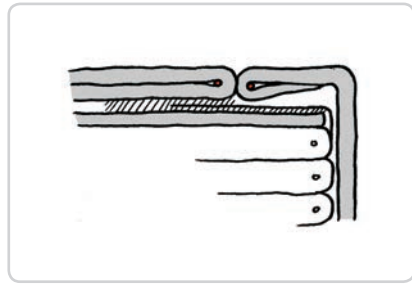

Fig. 18. Cross-section of Fig. 17. Here the red dots mark the location of the secondary sewing thread.

Fig. 19. Example of a 17th-century silver binding with a rod hinge at the British Library.

Fig. 20. Wire edge binding by Daniel Kelm on **Moth and Bonelight**, published by Jerry Uelsmann and 21st Editions in 2010.

conventional way and the rod hinge is only used as a way to create a working joint between the otherwise stiff metal boards and spine.

Since then things have moved on. Daniel Kelm has developed the wire edge binding, in which not only the covers are hinged with rods, but each *leaf* of the text-block to the next. These are stiff pages that have tubing elements attached to their spine edges, leaving free the occasional gap where they get connected in a next step. Daniel uses various methods of attachment and in Fig. 20 you can see an example that works with tubing, rods, and small metal loops.

Fig. 21. Piano hinge binding by Anne Giordan.

Fig. 22. Single hinge binding-in-progress by James Brockman.

Fig. 23. Magnetic hinges. Box for screw punch tools by Nadine Werner.

Another application is Hedi Kyle's piano hinge structure, in which horizontal incisions are made into the signatures, and the resulting tabs are 'woven' together and held in place by rods [Fig. 21].

And finally, we cannot talk about rod hinges without mentioning James Brockman and his extraordinary single hinge bindings. Fig. 22 shows a work-in-progress shot of James's latest binding and one can see how all three elements (front board, back board, and text-block) are laid out before being assembled. All elements are fitted with their rings, which will slot together and rotate around the single rod.

b5. Magnetic hinges

This is probably the most surprising solution for this survey, which is why I kept it for the end. Magnets are extremely common nowadays, but who would have thought about using them as hinges? The German bookbinder Nadine Werner did (Fig. 23).

ACKNOWLEDGEMENTS

- Many thanks to Joost Widdershoven, Anne Goy, Gabriel Zegna, Daniel Kelm, Anne Giordan, and Nadine Werner, who agreed to send me beautiful photographs, and thanks to them for checking their entries. Thanks also to Annette Friedrich, who first made me aware of the necessary space between board and shoulder in traditional binding. Thank you to my former boss Claudia Flade, who explained to me the difference between milled boards and bevelled boards.
- All photographs, drawings and bindings are by Benjamin Elbel except: Fig. 3 – © Gabriel Zegna; Fig. 6 – Joost Widdershoven; Figs 15, 16 & 18 – Michel Lechien; Figs 13 & 19 – public domain; Fig. 20 – Sami Keats; Fig. 21 – A. Giordan; Fig. 22 – J. Brockman; Fig. 23 – Nadine Werner.

EDITORS' NOTE

- Anne Goy has published a fine step-by-step manual on how to do the crisscross binding: *reliure CRISSCROSS – CRISSCROSS binding* by Anne Goy.