An Update on Bookmaking (The Art of Cardboard Book Construction)

Ron Bopp

In 1992 I authored an article "Bookmaking, A Bookie's Perspective ! (A History of Contemporary Bookmaking)" for the *Journal of Mechanical Music*.[1] Since the publishing of that article I have received updated information on the subject from many organ owners, including the late Ken Smith.[2] In recognition of Ken, and especially, the late Cliff Gray[3], who tutored me in the art of making blank cardboard book music, I am rewriting this article to include the valuable updates.

It is important to know that since 1992 many fair organ caretakers have chosen to use an electronic method of reading music, i.e. MIDI. While this certainly has its advantages, one looses the "aura" of the cardboard book playing through the key frame. Hand organ enthusiasts will attest to that phenomena as well—onlookers of organ music being played are much more attracted when a physical method is used to playing the organ, whether it is roll or book-operated. In addition, the method described here allows one to do it all alone, without the need for expensive electronic involvement.

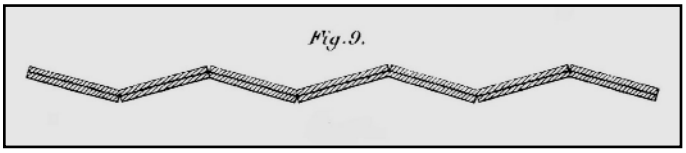

Figure 1. Anselme Gavioli et Cie's bookmaking patent (#240,689) entitled *Cartons À Musique* dated 2 October 1895.

The art of making blank cardboard book is necessary because of the difficulty in obtaining cardboard music from the few available sources. Finding original, playing music for a particular old organ can be like "finding a needle in a haystack." This as well as cost and time of production are factors that encourage individual organ owners to consider making (and later, punching) their own book music.

Making book music began in the 1890s (or earlier, to be discussed in a future article) when Anselme Gavioli et cie patented the process (**Figure 1**). Prior to this organs were operated via a pinned barrel. Book-operated organs had the flexibility to play longer (or shorter) tunes than any particular barrel would allow. In addition making book music is much easier than pinning a barrel (requiring less specialized equipment, and skills). The result is an expanded library of music.

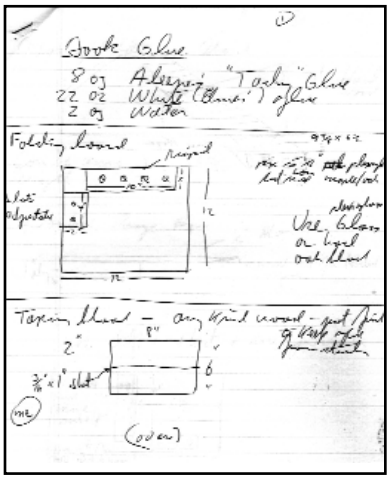

Figure 2. My notes from tutorage with Cliff Gray learning how to make cardboard book.

As a result of the importation of book-operated organs as well as restoration of those already in the country, the need for blank book for perforation has risen. The current interest was spearheaded by Jack Hewes (Kent, WA) who stated that he began making book music because an organ he was working on (in the mid-1970s) "had no playable music."[4] At that time Jack collaborated with Ken Smith, who helped design the jigs, press and punch needed for making the folding cardboard book. This process continued as Cliff Gray began punching music (over 2,200 meters in his lifetime) and I learned from Cliff (**Figure 2**).

Once the book is made, then punching out music is necessary and that apparatus and technique is discussed in "The Haughawout Punching Machine" on page four of this issue of the *Carousel Organ*.[5] Terry Haughawout produced many punches, all designed on the original one by Ken Smith.

Description of Book Music

Book music varies in size (width) from organ to organ. The length is dependent on the length of the music and can vary from just a few meters to over 50 for a potpourri or classical number. An example of this is the *Blue Danube Waltz* which is just over 29 meters long.

An excerpt from the book, *The Fairground Organ* by Eric Cockayne will suffice to describe this interesting process.[6]

> A cardboard music book consists of a long strip of folding cardboard on which music is scored either by punched-out rectangular slots [*for keyed music*] of varying lengths or by circular holes [*for keyless music*]. The strip is made from two layers of cardboard, each layer consisting of a row of cardboard rectangles, which have been creased down their centers. The two layers are glued together so that two adjacent edges of rectangles in the top layer lie over the central creases of the rectangles in the bottom layer. As the rectangles are creased, the strip can be folded quite easily, first one way and then the other in a zigzag fashion, to form a compact block, or "book" as it is called. The folds are sometimes [*usually keyless music*] reinforced with linen tape.

I will detail this interesting process described above by using portions of Cockayne's comments as headings for each section (in Italics).

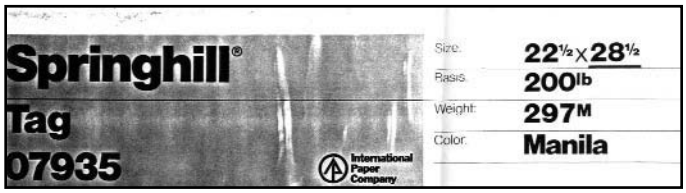

Figure 3. Springhill Manila Tag paper (single thickness cardboard), similar to file folder cardboard, used to construct the cardboard book.

Cardboard Rectangles
(Cutting to Size)

Where do we start? The first obstacle is obtaining the correct paper or cardboard to use. Using two layers of cardboard to approximate the thickness of the original book music for any particular organ is the first order of business. Getting cardboard that will hold up to numerous passes through the key frame is another consideration. Some years ago a grayish board, similar to that found on the back of paper tablets, was imported and used but many organ owners found that it did not hold up well. Ken Smith and Cliff Gray found that a paper similar to manila folders was adequate, when doubled, to approximate the music for moderate size German organs. This paper is Springhill Manila Tag (200#), as noted in **Figure 3**. It comes in several sizes but the 22 ½" by 28 ½" is a handy size to use and cut.

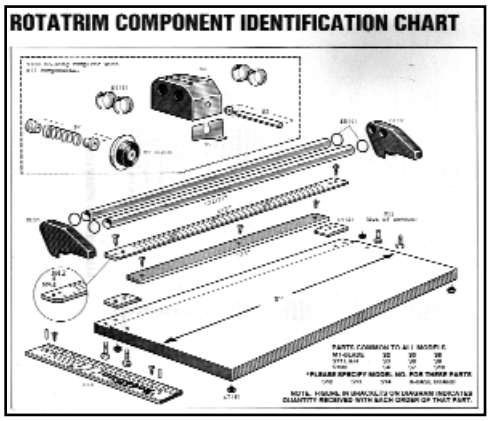

Figure 4. A schematic of the Rotatrim trimmer.

An accurately sized book will play much better in any organ but how do you accomplish this when making your own book. Trimming or cutting the cardboard may be done at the individual, "single-page" time of bookmaking or at the completion of an entire book. Trimming the cardboard to size prior to assembly is the easiest and most cost-effective way for an organ owner making just his own music. Many paper trimmers are on the market but the Rotatrim trimmer, made in England and sold by the Alvin company (found in graphic art supply stores/catalogs), is one of the more accurate ones (**Figures 4 & 5**). The 30" model is most practical for the size paper that is used. The ordinary paper trimmer using a guillotine type of cutting device is inaccurate as the paper will slide near the end of the cut and will not be true in size.

For my 52-key Bruder music I have set a permanent stop in two places on the Rotatrim allowing first for the width of my book (9 3/8"), and then for the length of two pages, 13" (6 ½" being the length of most European book-operated organs). When I get the width cut (I can get two pieces from this 22 ½" x 28 ½" piece of cardboard), I then turn the piece 90 degrees and cut it 13".

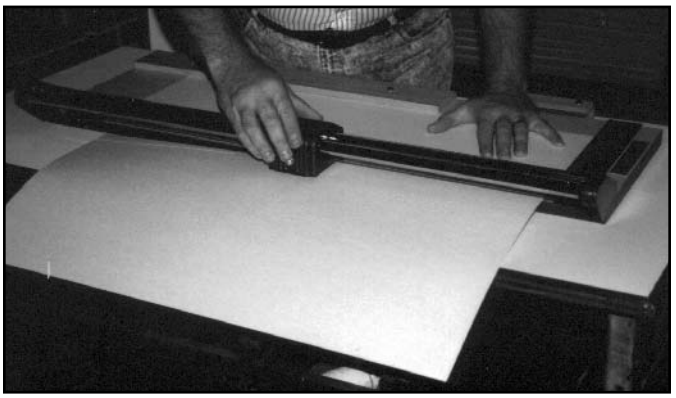

Figure 5. Using the Rotatrim trimmer to cut a length of cardboard into the proper sized pages.

Six pages (6 ½" long) conveniently make up one meter. The process of cutting and folding the cardboard is repeated until I have enough for a piece of music. Usually, 30 to 60 uncut sheets of cardboard will suffice for an average-sized book of 10 to 20 meters. i.e. . . . for a 10-meter book I have a stack of 60 sheets of single-thickness cardboard, 9 3/8" wide by 13" long.

An alternative source of sized sheets of cardboard is to have it accurately cut by your paper source. I have found that one printing company, from which I have ordered cardboard, has the capability to also cut the cardboard to size, thus saving one time-consuming step.

Trimming the cardboard book to size after its completion is another method of accomplishing the same accuracy. This, however, is usually reserved for a bookmaker who processes a large amount of material. Arthur Prinsen, Belgium, uses a cutting technique where he trims the cardboard book after it is assembled (**Figure 6**). He uses a razor-thin knife that trims the excess book as it passes through his machine.[7]

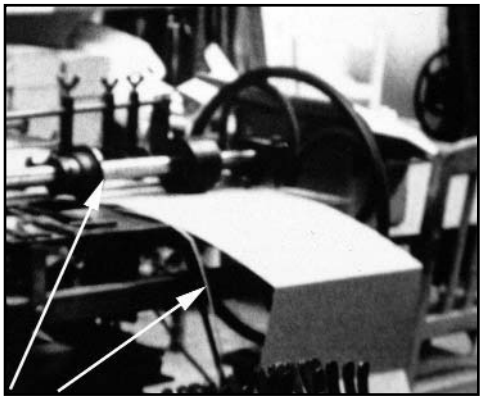

Figure 6. An automatic paper cutter used by Arthur Prinsen in action. The left white arrow points to the cutter and the arrow below is pointing to the waste material. Photo: Arthur Prinsen.

Cardboard rectangles which have been creased down their centers
(Creasing/Folding)

The next step is to make a folded page ("single page" as Cliff Gray referred to them). In **Figure 7** one method of creasing and folding, developed by Cliff, is illustrated. On the right of the photograph is a "folding jig" which has a hinged top to allow the cardboard to be inserted endwise. Then the top is brought down, with the cardboard squarely inserted. The cardboard is then folded over the edge of the jig with a wooden block. This puts a crease across the center of the cardboard and makes the next task of folding easier.

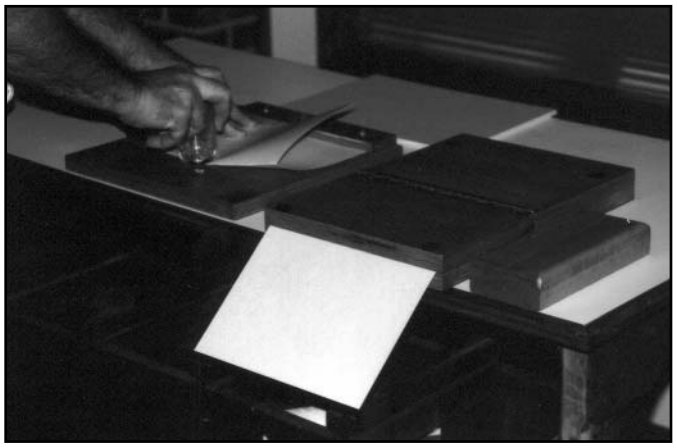

Figure 7. The cardboard is folded on the jig on the right and then creased with a jelly jar (or similar) on the left. This creates a sharp edge to the folded card which makes the overall book neater.

COAA member, Bob Conant, has a slightly different way of getting the crease in the cardboard (**Figure 8**). On the left one can see a wooden hinged cover (or "lip") attached to the edge of his folding jig. On the right, this cover is moved down putting a crease onto the cardboard.[8]

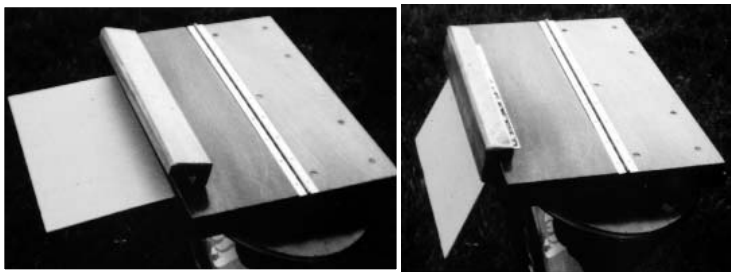

Figure 8. Bob Conants fold jig has an additional "lip" on the edge, allowing for the cardboard to be creased easily. Photo: Bob Conant.

Once creased the cardboard is moved to the jig on the left of Figure 7. This jig has two wooden guides screwed down on a wood platform. The guides are set at an accurate 90 degrees and the cardboard is pushed up against them. The ends of the cardboard are lined up square and the already-formed crease is then ironed out with a smooth-bottomed glass (like a jelly jar, etc.). I then turn the now-folded sheet and re-iron the opposite side to get a nice, sharp crease.

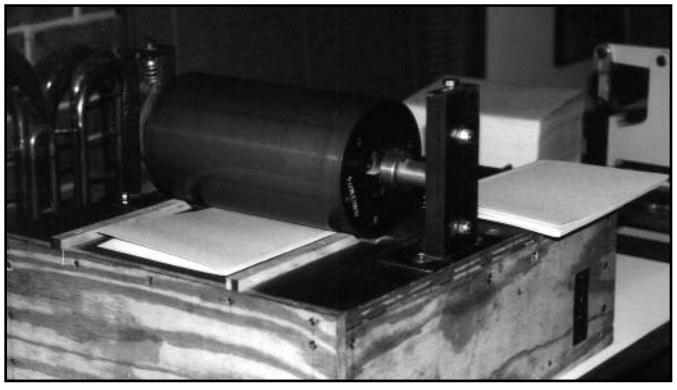

Figure 9. The now folded single page inserted in the roller press to create a sharp crease in the fold.

An alternative way of creasing and folding is to line up the edges of the cardboard and insert one end into a "roller press" that I had made by the late Ben Lilien, a mechanical music friend from Los Angeles (**Figure 9**). At first glance I didn't believe this would end up being as accurate as using the glass-iron method but after some practice it seems to produce the same results (and with quickness and ease). In reviewing the process performed by Arthur Prinsen I learned that he also uses a roller press to put a sharp crease on the folded cardboard.

The folds are sometimes reinforced with linen tape
(Hinge Taping)

Hinge taping is optional although most of the original German books were reinforced at the hinges with linen tape. If you are making cardboard books for keyed organs, there is less reason to use the linen tape. There are essentially two reasons to tape the joints: First, to add strength to the continuously bending cardboard. Second, and this is the more important indication, is to prevent "barking" or unintentional sounding of pipes or drums when the portion of the book that suddenly becomes one thickness (at a joint) passes over the key frame. By using linen hinges, this very narrow portion of the book then becomes as thick as the remainder of the book because the hinge material will bunch up when it is in the unfolded stage.

Figure 10. The hinge-taping process with the necessary tools.

In **Figure 10** we see the components necessary for gluing the linen tape to the hinged portion of the cardboard. The 0.75" x 0.007" linen tape (#7866) comes in 36-yard long rolls made by the Carolina Narrow Fabric Company of Winston-Salem, North Carolina. A roll of it is seen on the right in the photograph. This tape has to be ordered directly from the company, although recently, that has been difficult. The tape is also available through electrical supply houses as it is used for wrapping wires. Whatever the source make sure you obtain linen or cotton, plastic or nylon tape will not work as the glue (see next page for a description of the "glue mixture") will not stick to it.

The "Glue Mixture"

The glue that is used for both the hinge process as well as assembling the book pages together is a formula that was invented by Jack Hewes and has been referred to as the "Glue Mixture." 22 oz. of Elmer's White Glue is mixed with 8 oz. of Aleens Tacky Glue (available at most craft stores as well as Wal-Mart or K-Mart) and 2 oz. of water. This mixture was formulated to perform best when gluing pages together and serves as well for the process of hinge gluing. According to Jack this formulation gives the processed glue some "give" and keeps the hinged end from becoming too brittle. This formulation also gives the glue the appearance of crackled eggshell when applied to the pages by a paint roller.

In the left center of the photograph in Figure 10 a piece of folded-over cardboard sits in the holding block with a freshly applied piece of linen tape. I use either a ¼" thick smooth-edge piece of glass, or a cookie sheet, on which I place three or four pieces of precut linen tape. I usually cut about 1" extra length to allow for trimming later. I then take a hard bristle stencil brush and apply the glue over the tape on the glass. The gluing of the linen on the edges is a critical portion in assembling the book—if too much is allowed to bunch up on the edge, "barking" will occur when the book is played.

Cutting the tape can be a tedious job but I have made a cutting jig (**Figure 11**) which allows me to cut three pieces of linen tape at the same time and consistently to the same length. Examination of the tall portion of the jig will reveal that there are three rolls of tape. Finishing cutting of these three will provide enough tape for over 60 meters of music (I store the extra tape in an empty player piano roll box).

Figure 11. A jig used for dispensing three layers of linen tape to be cut at a time.

Once the tape is evenly applied, and the excess glue is squeezed off by using the pressed fingers, the pages are set in a drying rack (made by running a common 2" x 4" board across a table saw, using the kerf of the saw as the proper dimension to hold two thickness' of cardboard) and allowed to dry before trimming. Trimming may be accomplished by use of long scissors, or as I have preferred in recent years, a single edge razor blade held flush to the edge of the cardboard.

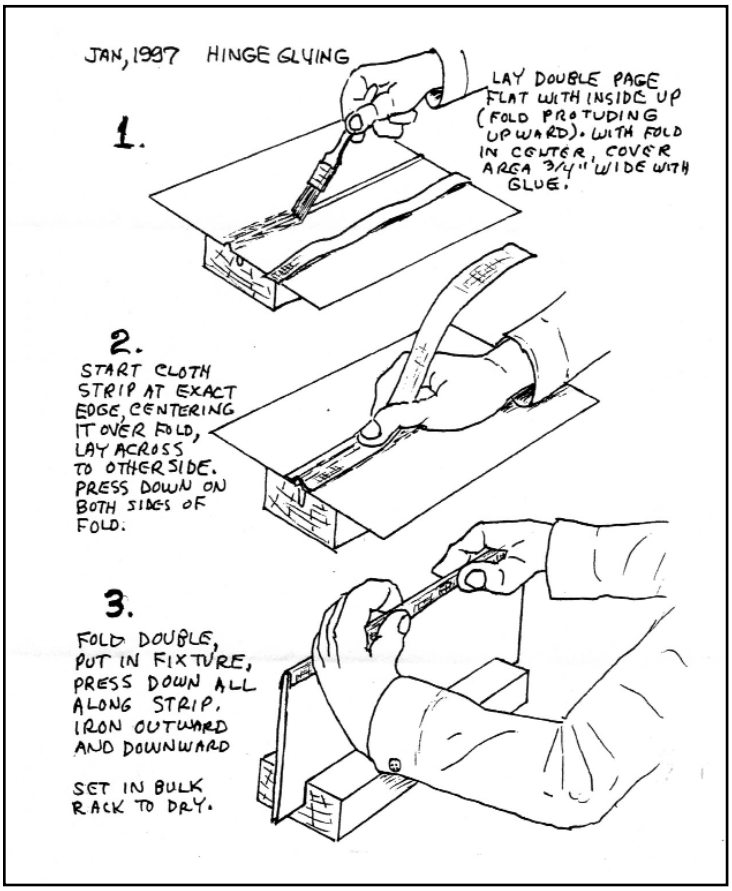

Figure 12. An alternative way of putting on a glued hinge to the book crease. Ken Smith archives.

In January 2003, Ken Smith sent me some new thoughts regarding constructing the cardboard book and one such idea was an alternative way of hinge gluing (**Figure 12**). Examination of this sketch by Ken will explain this method. Ken noted that:

> The point of this variation is to eliminate the messy process of applying glue to the cloth strips on a sheet of glass. Since one applies glue to each page, there is no accumulation and putting the dry cloth hinge on the glued area means less mess overall. Also, lining up the hinge end with the page end makes only one end that will have to be trimmed.

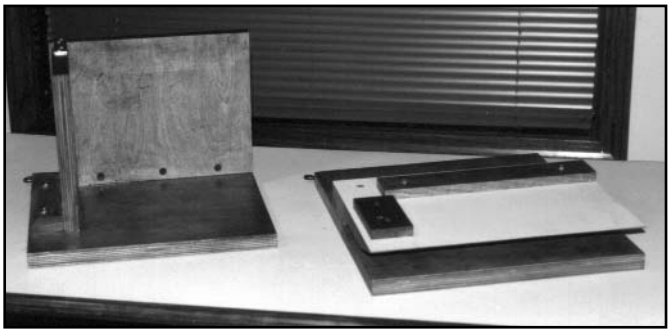

Figure 13. On the right is the double page-making fixture. The book assembly jig is on the left and will be referred to later.

Once these pages are dry and trimmed I run them again through the drum roller in Figure 9 to get a sharp edge. These are now referred to as completed single pages and wait for the next step of book making.

The two layers are glued together . . .
(Double Page Assembling)

The next step is to take single-hinged cardboard and form a double thickness that will eventually form a complete book. In **Figure 13** the double page-making fixture is on the right. This is a specific assembly jig that allows for assembling one single page to another while allowing 1/32" of the hinge end not to be covered (see **Figure 14** for one of Ken's drawing detailing this accurate jig). This is accomplished by making the distance from the edge of the jig to the backstop exactly 6 7/16"

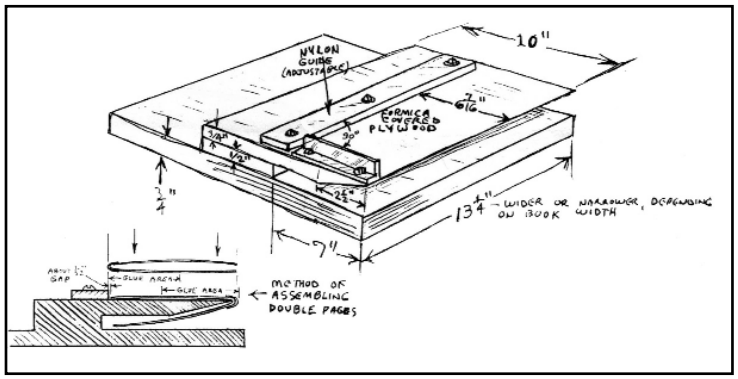

Figure 14. The double page-making fixture as designed by Ken Smith. Ken Smith Archives.

(for a 6 ½" book). This 1/32" plus an identical on the opposite side will allow for the linen hinge material to appear between the narrow gap of the opposing leafs of cardboard, and will, in turn, prevent "barking." The top of the jig is covered with Formica or aluminum to make a hard, stable surface (mine is Formica).

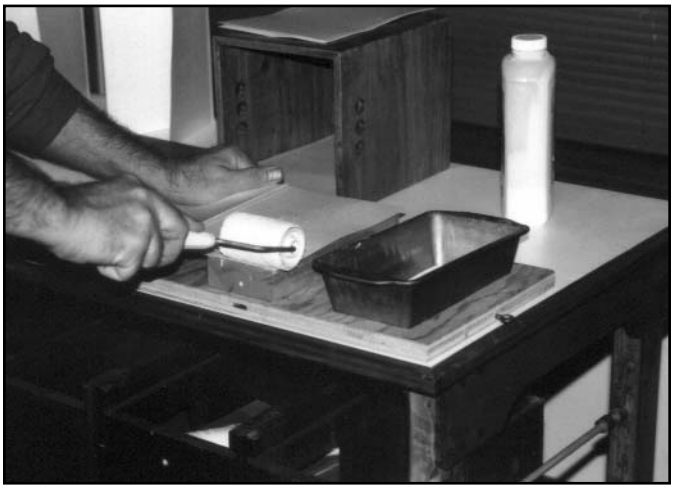

Figure 15. Applying glue to the outer 5/8 of each page with a trim paint roller.

The pages are glued together with a trim paint roller and the glue as mentioned on the previous page. In **Figure 15** we can see the roller spreading glue over portion of the book supported by a 2 x 4 board, just a little wider than the width of the book. The glue is contained in a bread pan or similar container that will allow for the roller to easily move back and forth. Once two pages are glued together they are inserted into a book press I made using components from an old sausage press (**Figure 16**). **Figure 17** is a drawing Ken Smith made in 1977 using ideas from Jack Hewes for the book press.

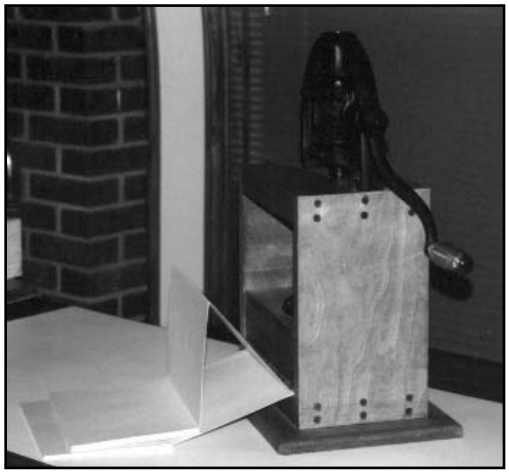

Figure 16. A book press I made using an old sausage press.

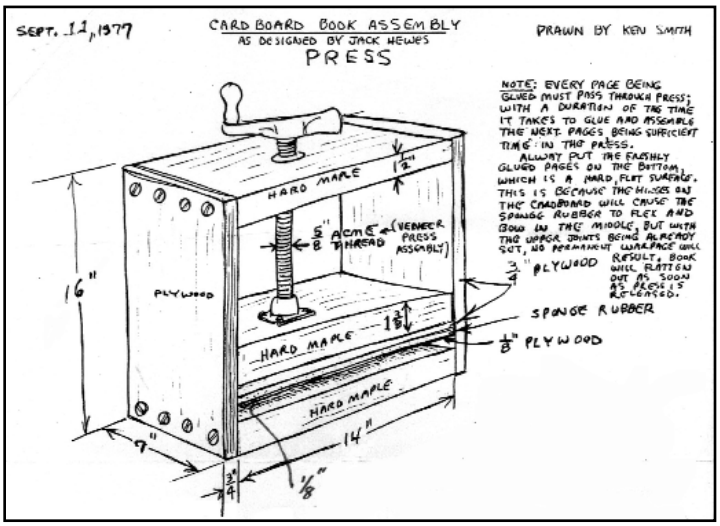

Figure 17. A cardboard book press assembly, designed by Jack Hewes and adapted from a drawing by Ken Smith. Ken Smith Archives.

The two glued single pages (now referred to as a "double page") are glued together only long enough to glue the next two pages together. They are then removed, set up to dry and the next two glued pages inserted.

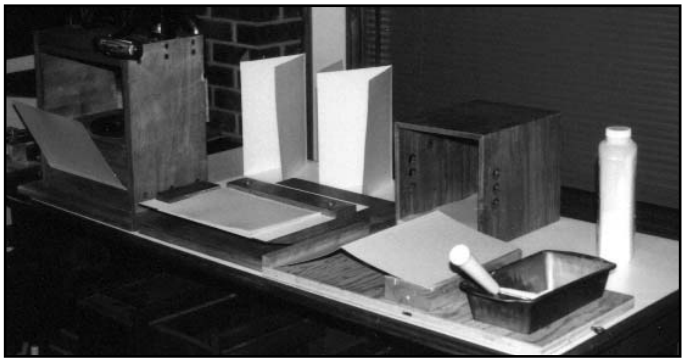

Figure 18. Making double pages from single pages—the entire process from right to left.

Figure 18 illustrates the complete line-up of making double pages. On the right is the pan and glue roller; it is sitting on the jig to hold the single pages while being glued; to its left is the double page-making jig and to the far left is the book press. Behind the jigs and press stand two completed double pages that are drying.

Figure 19. Several double pages drying while another is in the press on the right.

This all sounds complicated but actually it is one of the faster portions of the bookmaking process. As I get the two pages glued and put into the place on the double page-making fixture, the last two pages have set up well in the press. Then I take them out of the press, set them on edge to dry and proceed with the next two pages. Finishing the completed 30 double pages can be done in less than one hour (**Figure 19**).

***. . in a zigzag fashion, to form a compact block, or "book"* (Complete Blank Book Assembling)**

Assembling the remainder of the 30 double pages is now accomplished by using the book assembly jig (**Figure 20** and left portion of Figure 13) which is nothing more than one-half of a wooden box with true 90-degree corners. The edges of a double page are glued on the outer five-eighths of each flap (as before) and placed in the corner of the jig. Once two are joined they are placed in the press for clamping while the next two are made. This process is done over and over until all of the glued cardboard material is finally glued together to form a complete book.

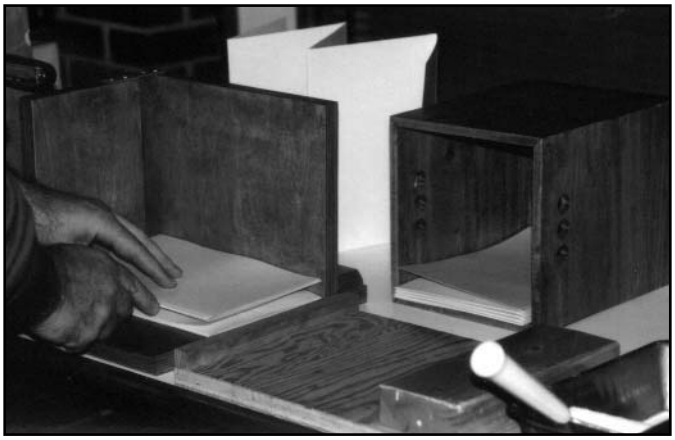

Figure 20. The book assembly fixture (left) allows glued double pages to be stacked in much the same manner as single pages.

The overall process of making blank cardboard book takes me about eight hours to complete 20 meters. Once this completed and the book has had chance to dry I run the blank book through my organ's key frame to make sure I don't have any "barks." If so, it is usually where one portion of a hinge is protruding a little more than the rest—simply sanding this down with fine grade sandpaper will correct the problem. Then the process of punching the music begins.

Figure 21. Jack Hewes posing with the book-copying, stencil machine he designed. Note the dark roller on top of the out-coming paper—this is carbon paper turned so that the smudgy portion is on the outside and, therefore, making an imprint on the paper. Photo: Dan Slack archives.

The book punch is described in Terry Haughawout's article, "The Haughawout Book Punching Machine" (mentioned previously), so that won't be described here. Of interest, however, are the methods of obtaining music to punch the blank book. Tracing music from old music can be done but it is time consuming. Using original books to mark with a marker or sponge works well but defaces the original music (I use this method only when working with unplayable, old music). Of course I obtain permission from the owner of the music if it is not mine.

A time-proven method is copying original music using a stencil machine such as the one designed by Jack Hewes (**Figure 21**). Using washing machine rollers, the blank stencil paper (newsprint, exam table paper, or something thin and mark-able) is compacted between the original book and a roller covered with #2 pencil carbon paper (blue pencil Nu-Kote brand, #60-10-11 ½" works best) which is taped on the roller inside out—the smudgy side out (**Figure 22**). This is accomplished using a built-in clamp on the stencil machine. Turning the attached crank then advances the original book as well as the now-marked stencil.

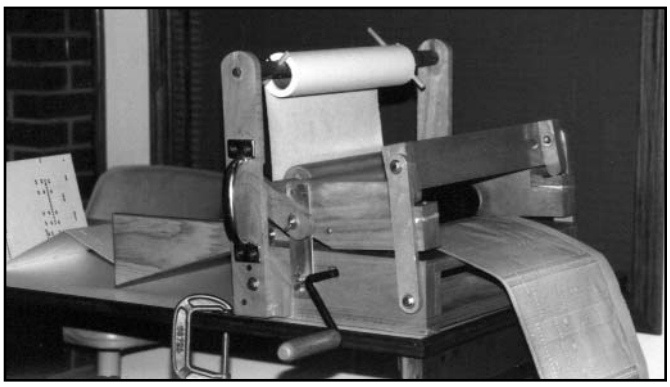

Figure 22. A side view of the stencil machine revealing the crank on the lower portion and the wood clamp forcing the carbon-carrying roller over the thin copy paper to make an imprint.

The results are seen in **Figure 23**. On top is the original book and on the bottom is an identical copy, but on a thin stencil paper that can be trimmed and stapled to the blank book material, made ready for punching. Mr. R. de Waard described this (*From Music Boxes to Street Organs*) quite well[9]:

> The punching of the organ books proceeds as follows: the roll of paper on which the music is written . . . in technical terms called the "type" [*stencil*] . . . is fastened to the folds of the book section by section. The cardboard with the type fastened to it is then placed on the table in such a way that the top edge is pressed against the adjustable upright at the back of the table [*punch table*].

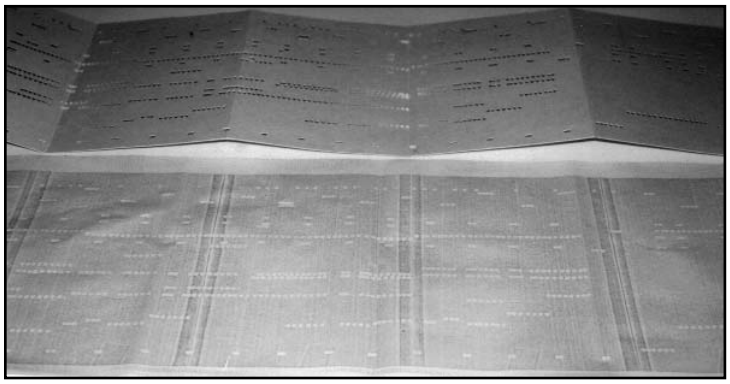

Figure 23. A photo showing identical pieces of music for the book organ. On top is the book that was passed through the stencil machine and on the bottom is a thin stencil made from that book. This, then, will make the ideal medium to punch through the blank book.

An alternative source for music is obtaining new stencils. I have obtained such stencils from arrangers in Europe. In the last few years, Wayne Holton of Houston, Texas, has been a great source for music stencils and his arrangements are on the same excellent level as original Bruder music.

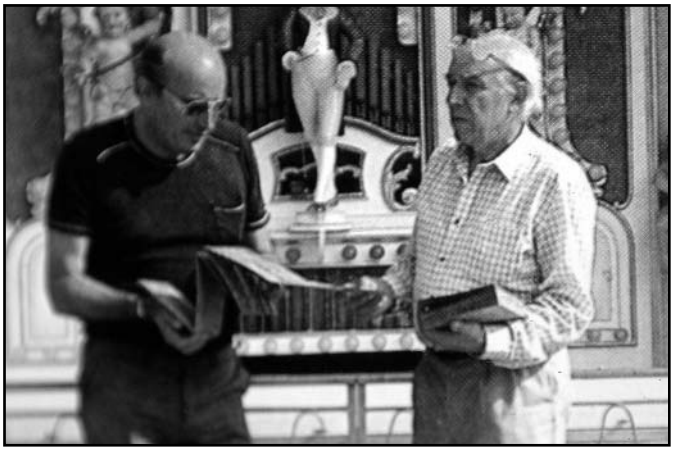

Figure 24. Erich Guehrer, owner of the Style 33 Ruth (background) inspects a book made by the former Car Frei, Jr. Carl Frei maintained this organ for years.[10] Photo: Dan Slack Archives

Summary

I have led you from start to finish in producing a blank cardboard book. It sounds like a lot of work but the finished product is quite worth the effort. And, when you have then punched out your new piece of music you will have the satisfaction of creating music that should last for many years, or decades.

And, as I mentioned in my previous article of 1992 you can:

- produce music at your own rate
- have a large selection of music for your organ
- save money and time
- enhance the value of your organ
- and the satisfaction in starting with a piece of cardboard and finishing with a complete book of music.

All photos by the author unless otherwise noted.

Notes

1. Bopp, Ron, "Bookmaking, A Bookie's Perspective!," MBSI's *Journal of Mechanical Music*, Winter, 1992.
2. Smith, Ken, Personal Communication, January 2003.
3. Gray, Cliff, Personal Communication, 1991.
4. Hewes, Jack, Personal Communication, 1992.
5. Haughawout, Terry, "The Haughawout Book Punching Machine," *Carousel Organ*, #23, April 2005.
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