Bookbinding by hand: An automated backing press

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***Abstract*—Binding books by hand is an old craft. As mass production of books is now readily available, this art is mostly performed by hobbyists or small companies making bespoke items for collectors. The hand binding is often performed using old tools. Most of the research in the field of bookbinding focuses on big industrial machines. We will present an efficient backing press, combining new and old technology, to aid hand bookbinders.**

I. Introduction

Binding books by hand, though time consuming, generally produces a higher quality binding than industrial binding. Because of this difference in quality hand bound books are still being made even though cheaper mass produced books are available. One part of binding a book is called backing. Backing is the process of hitting the spine of the book with a hammer until it achieves a round or mushroom like shape. See Fig. 1 The backing itself is quite simple, but placing the book tightly in a press, so that it does not budge, wile also perfectly aligning the book, can be a bit finicky and time consuming. You may find yourself thinking that you should have had three of four arms. We aim to make an automatically closing backing press to reduce frustration and time spent when pressing a book for backing. We will do this by using a motor to close the press. The motor will be activated by a pedal so that both of the binders hands will be free to align the book.

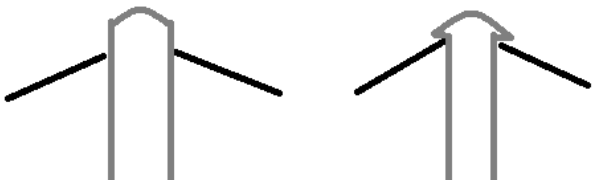

Fig. 1. Here you can see the difference between a book that has not been backed and a backed book.

II. Background

A. The backing press

To get some inspiration for our backing press we looked at how a bookbinder will usually press his book for backing.

One way to press the book for backing is by using a press shaped specifically for backing. See Fig. 2 for a drawing of a backing press. When using these presses it can be difficult to align the book perfectly, as one hand will be occupied with manually closing the press. These presses are often shaped in a special way so that the book is only in contact with the press in one specific point. See the red points in Fig. 2. It is shaped like this to hold the book more securely in place, and also to allow the pages of the book to move a bit as the book spine is being shaped.

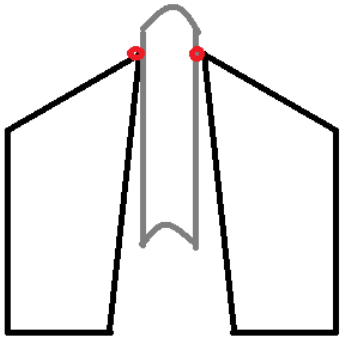

Fig. 2. Here you can see a drawing of a backing press.

Fig. 3. Here you can see backing boards in a press.

The most common way of backing is perhaps by using backing boards. See Fig. 3 for an example of backing boards. With these boards it is easier to align the book perfectly in the press. You can first align the book perfectly between the boards, and then hold the book tightly in between the boards with one hand while closing the press with the other hand. See Fig. 4. One problem with this method is that if you accidentally hit one of the boards too hard with the hammer

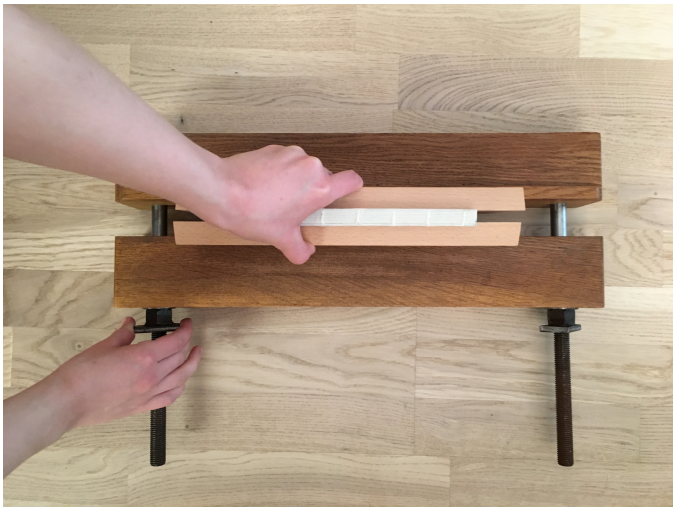

Fig. 4. Here you can see a aligning of backing boards in a press.

while backing the boards can easily be knocked out of place. If this happens you may have to do the whole process again from the beginning.

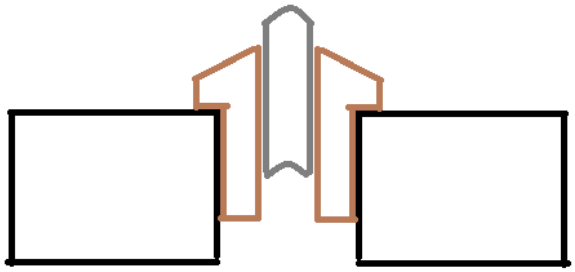

Fig. 5. Here you can see a drawing of backing boards with ledges.

Some have tried to make baking board that have a ledge holding them in place in the press. See Fig. 5. These will not easily be knocked out of place. The problem with these boards is that you can not achieve the same slant as with the other boards, so press will be in contact with the whole side of the book.

It is quite common to have a metal lining on top of the boards or press that is being used for backing. This is because the wood of the press or boards quickly wears down from being hit by a hammer if it is not protected by something.

III. Method

A. Prefabricated components and tools

We used some prefabricated components for our backing press.

We used a stepper motor from sparkfun[1], a stepper motor controller from sparkfun[2], an arduino[3] and threaded rods from igus[4].

We also used several tools. We used a hp jet 3D-printer[5], a Zing laser cutter[6], two component epoxy from Araldite[7], an ender 3D-printer[8], a vertical milling machine, a band saw, and a circle saw.

B. Making the press

When making the press we started by fitting a threaded rod to a motor via a belt bearing.

We did this by glueing a nut, that fit the rod, to a 3D-printed piece, using epoxy. The 3D-printed piece was also connected to a belt bearing. The belt bearing was glued to the motor with epoxy, and the belt turned a similar mechanism for a second threaded rod. See Fig. 6 for the 3D-printed piece, this one was printed with the hp printer. And Fig. 7 for a drawing of the whole mechanism.

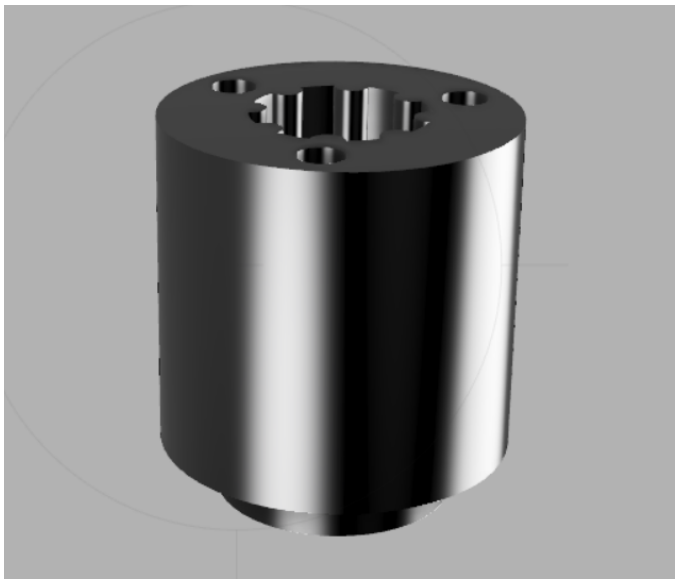

Fig. 6. This is the piece that connected the nut to the belt bearing.

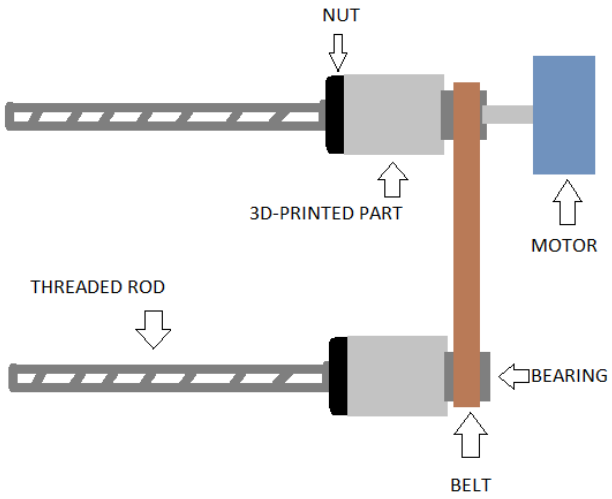

Fig. 7. Here you can see a drawing of the motor mechanism.

After this we made the wooden boards that hold the book in place. Two oak boards were cut with a circle saw to make the

edges slanted. See Fig. 8. We then reduced the bottom edges of the boards, using the milling machine, to make them the same height. See Fig. 9. We also used the milling machine to make holes in the boards for the threaded rods.

Fig. 8. Here you can see a drawing of how the boards were cut with a circle saw.

Fig. 9. Here you can see a the reducing of the wooden boards.

We fastened nuts that fit the threaded rods to the board that is moved by the motors, so that when the rods turn, the nuts will move up and down the rod, and therefore move the plank.

We used the laser cutter to make a frame out of acrylic to mount everything on. And then assembled all the pieces. The moving board was connected to the acrylic frame with sliders to reduce friction. We had to 3D-print custom pieces for the sliders so that they could be easily mounted to the moving board. The slider pieces were printed with the ender printer. See Fig. 10 for the slider pieces. We also 3D-printed a box for the motor, that was used to connect the motor to the frame. The box was printed with the HP printer. See Fig. 11 for the motor box.

When assembling everything we first fit the parts together with double sided tape to make sure everything was correct, before connecting them with screws.

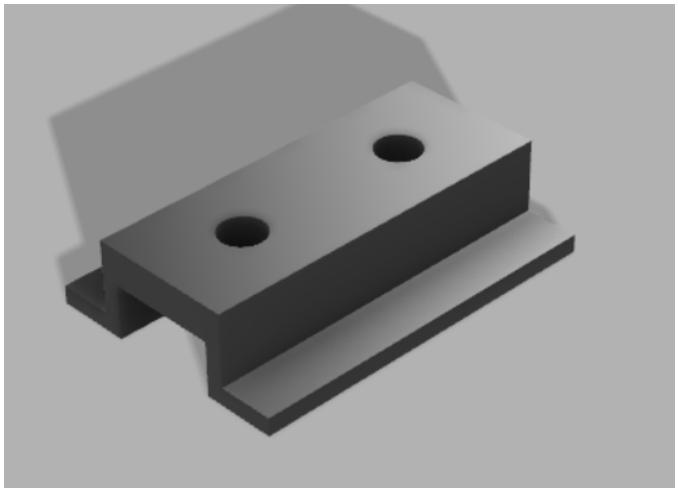

Fig. 10. Here you can see the pieces for the sliders.

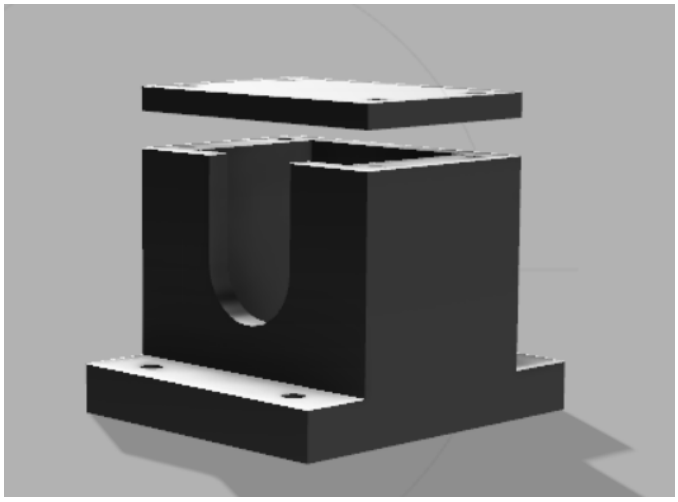

Fig. 11. Here you can see the box for the motor.

IV. Results

The finished press can be seen in Fig. 12.

When testing the press we encountered some problems. The motor was too weak to hold the book tightly enough in the press. This meant that the book would move slightly when hit with the hammer unless you tightened the press a bit more by hand.

The belt and the bearing did not fit completely. They almost fit, so it was difficult to see that they did not. Because of this the belt would skip a bit with regular intervals causing the wood beams to become slightly misaligned.

On the positive side the wooden beams glided well on the sliders, with low friction. The press opened and closed easily when we turned the motor. We thought we might have to glue the threaded rods to the 3D-printed part fitting them to the motor to keep them from disconnecting themselves instead of opening the press, but this was not necessary due to the low friction in both the threaded rods and the sliders.

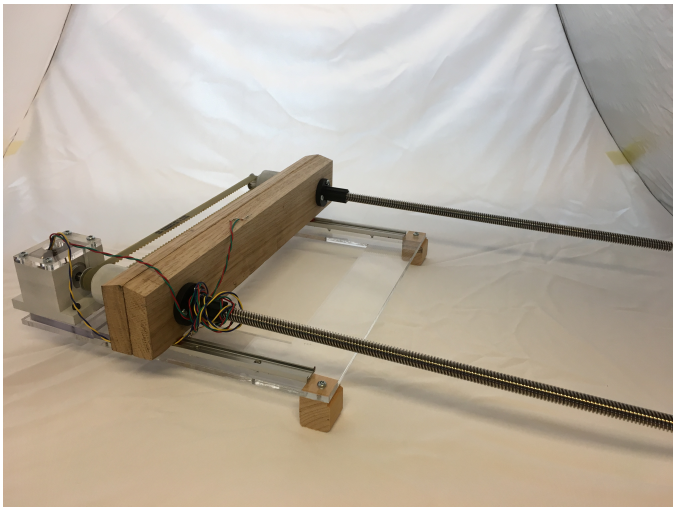

Fig. 12. Here you can see the finished press.

V. Related work

All other similar automated backing presses or machines that we found were big industrial machines. These work very well for backing books, but they are large, and meant to be used in factories.

A. A backing machine from 1914

This machine is called "An Improved Rounding and Backing Machines for Book Binding"[9]. It works by feeding the book into place, and then moving over the spine with a roller, automatically backing the book.

B. A backing machine from 2000

This machine is called "Device for backing bookbinding block"[10]. It works quite similarly to the machine from 1914, by rolling over the spine with several round bearings.

C. A backing machine from 2018

This machine is called "Novel easy operation's hardcover backing machine"[11]. It works by pressing the book into a mould that shapes the spine.

VI. Conclusion

We believe that with a few modification, as described in future work, the press will work as intended and make backing books easier for hand bookbinders.

A. Future work

Of course we would like to finish setting up the arduino and brass linings that we did not have time to finish, and also switch out the belt and bearing that did not fit together properly, but besides this there are also some other improvements we think we could make for the press.

In the future we would like to switch out the motor used with a more powerful motor so that the book will be held more securely in place.

We would also like to make the wood beams of the press properly slanted, instead of shifting the brass linings, to compare these two methods.

We would like to attach pedals so that the press can be opened and closed using your feet.

Also we would like to test the overall strength and durability of the system, and create a more durable frame.

VII. Acknowledgement

I would like to thank the lecturers of the course IN5590, and the engineers of the ROBIN research group at the department of informatics at the University of Oslo for giving me the opportunity to make this press.

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