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RECONSTRUCTION OF WOODEN COMMON PRESS

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I. ABSTRACT

The Melbert B. Cary Graphic Arts Collection at Rochester Institute of Technology is one of the country's leading collections on the history of graphic communications, with particularly strong holdings relating to printing history. This includes a collection of presses spanning the nineteenth century, but none from earlier periods. For the entirety of printing history prior to 1800, wooden presses were the means by which printed materials were produced. This gap in the collection's holdings lead to the development of a multidisciplinary team of five students dedicated to creating a reconstruction of an eighteenth century wooden common press. The final product would be a historically accurate, full-scale press representing a defined time period. The wooden common press will function, as would an original press, and will be used for demonstrational and instructional purposes to educate future students, historians, and printing enthusiasts alike on the engineering of the past.

II. INTRODUCTION

Fewer than 90 wooden presses produced prior to 1820 still exist, and all of them held by institutions. Barring the chance of one coming up for sale, the next best option for ownership is to make one. The modern concept of engineering did not exist when these wooden presses were produced, and as a result almost no documentation exists from any historical period. Most printer's manuals describing the design of wooden printing presses are interpretations of Joseph Moxon's *Mechanick Exercises on the Whole Art of Printing*, published in 1683.

Over the course of the twentieth century individuals produced replicas and reconstructions of presses, but there is little documentation available from their projects. Famously, Clinton Sisson and Elizabeth Harris produced *The Common Press* in 1978, which included detailed drawings of the Benjamin Franklin Press held by the Smithsonian Institution. The only other detailed plans were for a press produced by Ralph Green, an engineer and amateur printing historian, in 1949 for Colonial Williamsburg. These plans are only available from the Earl Gregg Swem Library at the College of William and Mary, and their historical accuracy has since been questioned.

The best way to collect useful data on the design of printing presses was to examine surviving examples. Figure 1 is a map displaying the 5 presses visited by the team. The most important factor for the Cary Graphic Arts Collection was that the final product be as historically accurate as possible. This would be reflected in the design of the press, its operation, and the materials chosen to produce it. The team traveled to Canada and four U.S. states to examine four original presses and one reconstruction. These presses, in addition to materials relating to presses held overseas, formed the basis upon which the final product was designed and produced.

III. DESIGN PROCESS

The operation of the press did not change throughout the eighteenth century. The paper was held between the tympan and frisket, positioned under the platen, and a screw mechanism with a handle was used to make the impression. These presses were two-pull presses, meaning two pulls of the handle with the paper at two different positions were required to print one full side of folio-size sheet of paper. The materials and appearance of the press, however, were closely related and dependent on time period and where the press was made. For the sake of historical accuracy, it was important not to mix and match design elements from different time periods or locations.

There were differences between presses produced in England versus those in continental Europe. The most obvious difference is in the hose, an assembly that aligns the spindle with the platen. English presses used a box style hose, which was a solid wooden block with cavity for the spindle bored out. European presses featured a hose commonly referred to as a Blaeu-style hose, which was an iron frame. The team chose to focus exclusively on English-style presses.

The carriage, which the bed rides on to position the page, saw a key design change from early iterations of the press to iterations present in the late 18th century. The planks of the press, upon the bottom are mounted cramp irons that act as bearings, runs along the rails on the carriage. On early presses, the sides of the carriage were tall pieces called guide boards, which kept the bed on the rails. On later presses, these guide boards were eliminated in favor of modified cramp irons with shoulders that rode on the sides of the rails to serve the same function. The modified cramp irons reduced the wear on the carriage and plank, resulting in fewer parts that needed maintenance.

Figure 1: Map of presses visited by Team.

Over time, there were also differences in how the girths were fixed to the plank. On early presses, the girths were nailed directly to the plank. With regular use these girths required repositioning to ensure they were taut. This resulted in several nail holes that eventually damaged the end of the plank. Later, these girths straps were fixed to the plank with a clamp. With this improvement, any repositioning only required loosening the thumbscrew on the clamp to reposition the girth. This change increased the longevity of the plank.

There were two factors that ultimately drove the team to decide to base the design on English common presses built between 1770 and 1790. The first was the improvements and features listed above, which were present on presses of this period. The

second was that a press present in the late eighteenth century in the U.S. would not have been of this style, but a third, American style that drew design elements from these presses.

Early in the design process for the team's press, Sisson's published engineering drawings of the Ben Franklin Press (c.1720) were crucial in understanding the various components of the press and how they fit together. Throughout the course of the project, these were often used as a reference when trying to understand relative proportions or more detailed features.

IV. DETAILED DESIGN

The history of printing is well defined and well documented, but the overall structure of the wooden common press and its details are not. Wooden common presses were created in a time when emphasis on detailed, pictorial descriptions of objects was uncommon. Engineering design did not exist at all in a way similar to the modern sense. The challenge in designing this press was finding the details that were never recorded, or recorded poorly.

A design motif seen on all presses, in person and in photos, was the amount of adjustability each press had. This was presumably to compensate for wood shrinkage and expansion, and accuracy of machining, so that a slightly oversized or undersized part could be compensated for. Although, these may not be a concern with modern manufacturing, they were a concern in the 18th century, and as such were reflected in the final design.

Many of the dimensions used in the project were based on the team's measurements of the Roy Press from the Mackenzie Printery & Newspaper Museum. It was the only press the team was able to visit that was from the target time period. Pictures of other presses, such as the Apenshaw Press at the Discovery Museum in England, which is also of the correct time period, were used to estimate unknown dimensions based on relative proportions.

The press was broken down into eight subassemblies as shown in figure 2: 1. hose, 2. platen, 3. bed, 4. carriage, 5. cheek, 6. feet, 7. rounce, and 8. hindposts. The feet assembly consists of four parts: two feet, left and right, and two crossbars that hold the feet together. Because the width of the feet assembly defines many of the other dimensions and the printable area, the feet dimensions were modeled after the Roy Press to ensure the feet and all other subsequent dimensions were historically accurate.

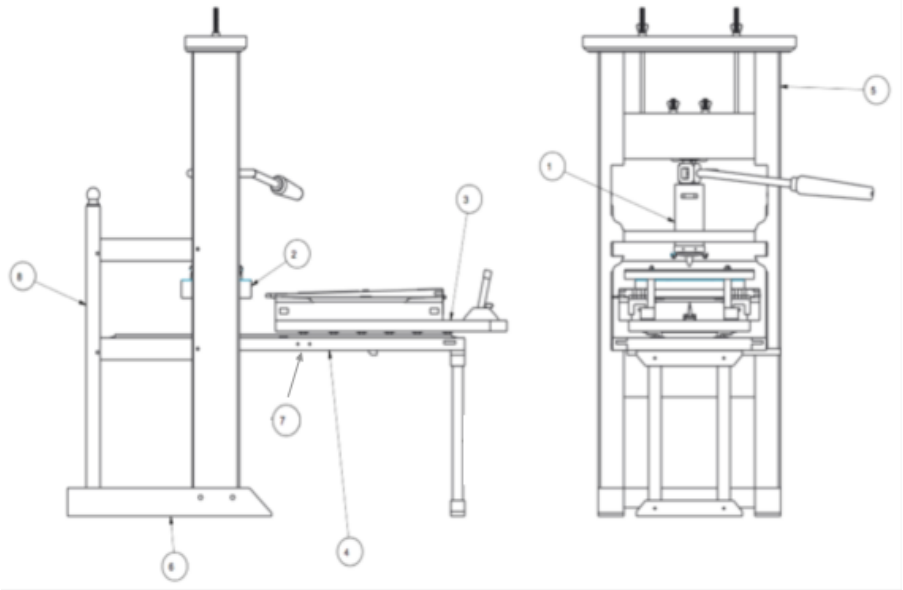

Figure 2: Assembly drawing of press.

The cheek assembly consists of the large uprights, the cheeks, and the dovetailed parts between the cheeks. In order from bottom to top, these are the winter, till, head, and cap. Because the cheeks are such a prominent part of the press, their dimensions were, again, derived mostly from the Roy Press. This includes the size as well as the locations of the dovetails, which hold the winter, till, head, and cap. The moldings on

the cheeks were selected according to shapes and designs consistent with presses of the late 18th century. The sizes of the winter, head, till, and cap were drive by the distance between and the depth of the cheeks. The heights of these were derived from trends seen on the Roy Press and the presses in New England.

The hose assembly is the heart of the press. It houses the spindle, which is attached to the bar and platen that makes printing possible. The external components of the hose assembly, hose, garter, and associated hardware, were simple to design based off images. Internal parts, the spindle and nut, were much more difficult since none of these were accessible to measure. The Franklin Press, whose plans served as a model, influenced the shapes of these parts.

The platen assembly is also a key part. The platen is the component that presses the paper on the type and is pushed down by the spindle. The size of the platen defines the printable area. The size of the platen was dictated by the size of the desired sheet size. The hooks that hang the platen from the hose were based visually on the presses the team observed. The sizes and dimensions were estimated. The platen plate, which distributes the force applied by the spindle, was based on these presses.

The bed of the press is used to hold the paper while the impression is being made. It consists of the plank, coffin, stone, gallows, tympan, frisket, cramp irons, and girth clamp. The coffin holds the stone, and both sit on the plank. The tympan holds the page and is attached to the coffin using metal hinges. When raised, the tympan rests against the gallows. A sheet of paper is placed on the tympan and held in place with the frisket. When lowered, the tympan rests on the stone. The stone acts as a hard surface to hold type. Lastly, the girth clamps hold leather girths to the plank so that it may be moved under the platen. Because these components are largely involved in the print and quality of the print, these were based on the Roy Press and Franklin Press. The girth clamps and their dimensions were based on photos of the Apenshaw Press. The cramp irons were based on the later style of cramp irons with built in stops. These dimensions were estimated based on photos of the Roy Press.

The carriage sits between the cheeks of the press and rests on the winter; one face rests against the hindposts and the other extends about four feet past the cheeks. This end is supported by the forestay. The bed rides on the metal rails of the carriage. The width of the carriage was defined by the space between the cheeks; the length of the carriage was defined by the space required to bring the bed out from under the press in order to remove and place a new sheet of paper. The height of the forestay was designed to be the same distance from the floor to the top of the winter, in order to hold the carriage level.

The rounce assembly holds the spit and rounce barrel. The girths attached to the bed are nailed to the rounce barrel. A handle allows the printer to rotate the spit and barrel to move the bed under the press. Two hangers are bolted to the carriage, and these hangers hold the spit. The other dimensions drove the dimensions of these parts on the press. These parts were primarily designed according to their aesthetics. The hanger design was taken from the Roy Press and photos of other late-eighteenth century presses.

The hindposts sit behind the cheeks and attach to both the feet and cheeks. They act mostly as a guard and reference point for the carriage, but also help prevent twisting of the cheeks during operation. Their dimensions were derived from the Roy Press. The dimensions of crosspieces that attach the hindposts to each other and to the cheeks were driven by the space available. Earlier presses, such as the Franklin, had ornate hindposts turned similarly to a decorative railing. The design created for this press kept the hindposts square with a turned ball on top. This style matches many later presses like the such as the Roy Press and Apenshaw Press.

V. SOURCING & PROCUREMENT

One of the more challenging aspects of the project arrived at the sourcing and procurement of labor and materials. The press is made of 52% wood , 44% metal, and 4% other materials, such as stone, leather, and rope. Materials were carefully selected based on historical research of materials used during the late eighteenth century for presses. In visiting various presses throughout the east coast, the team speculated on wood species used based on visual analysis of the wood grain structure. Historic printer's manuals specified that presses were made from oak and mahogany. Most likely, "oak" referred to English oak, *Quercus robur*. The team chose to use American white oak, *Q. alba*, because it has almost identical properties both visually and mechanically. "Mahogany" in the eighteenth century would have referred exclusively to Honduran mahogany.

Finding large enough timbers for parts such as the cheek proved to be incredibly difficult. During the first semester of the project, several suppliers were contacted, all of whom did not carry large enough material. In today's woodworking practice, it is common for smaller pieces of wood to be glued together to desirable sizes. This method is more cost effective and efficient because smaller pieces dry faster than larger ones. Historically, this technique did not exist. Therefore, selecting wood in the 21st century to build an eighteenth century press seemed like an insurmountable task at times.

The team eventually found New England Naval Timbers, a naval sawmill company located in Cornwall, Connecticut, who were able to provide large enough timbers. The team purchased a flitch nine feet long, nine inches thick, and 45 inches wide. The flitch still needed to be dried another 3-4 months in order to reach a suitable moisture content to begin making parts. In the meantime, the search for a capable craftsman was under way.

In order to maintain historical accuracy in construction, the team contacted craftsmen in the woodworking and blacksmithing trades. The limited availability of craftsmen willing to work on the project forced the team to search outside the Rochester region. At first, the team sought to bring on another team member, preferably a student or alumnus from the Rochester Institute of Technology School for American Crafts. Due to the huge time commitment, the team chose to hire professional who would better meet the demands of the project.

A total of nine blacksmiths across the northeast were reviewed and contacted as possible craftsmen. Many refused the job due to the prolonged time commitment. However, a suggestion from an RIT professor led the team to the Genesee Country Village and Museum, whose blacksmiths were willing to help. The project's woodworking was done by S. F. Spector, Inc. in Harrisburg, Pennsylvania. All other parts, including the stone, hemp rope, and leather girth straps were purchased from other suppliers.

VI.CONSTRUCTION

As noted, the parts for the press were fabricated at multiple locations. A blacksmith at the Genesee Country Village and Museum forged many metal parts, while the rest were machined in the KGCOE ME machine shop at RIT. Forging was chosen in order to give the parts the appearance as parts on the original presses. The other metal parts were machined either because of their complex geometry, time constraints, or both. S. F. Spector almost exclusively fabricated the wooden parts. These were created using both modern machines and traditional hand tools. Other wooden parts such as the rounce handle and bar handle, both made of beech for historical accuracy, were turned on a lathe by a volunteer from Genesee Country Village and Museum.

The team had exactly 16 weeks to construct a final product. Capturing construction progression was essential in order to keep to project schedule. Figure 3 is a screenshot of the tool used by the team to display the progress of each part on a weekly basis. The progress tracker measured where in the process of crafting, finishing, and test-fitting each part was through a red, yellow, and green approach. Red meant the process had not been started for that

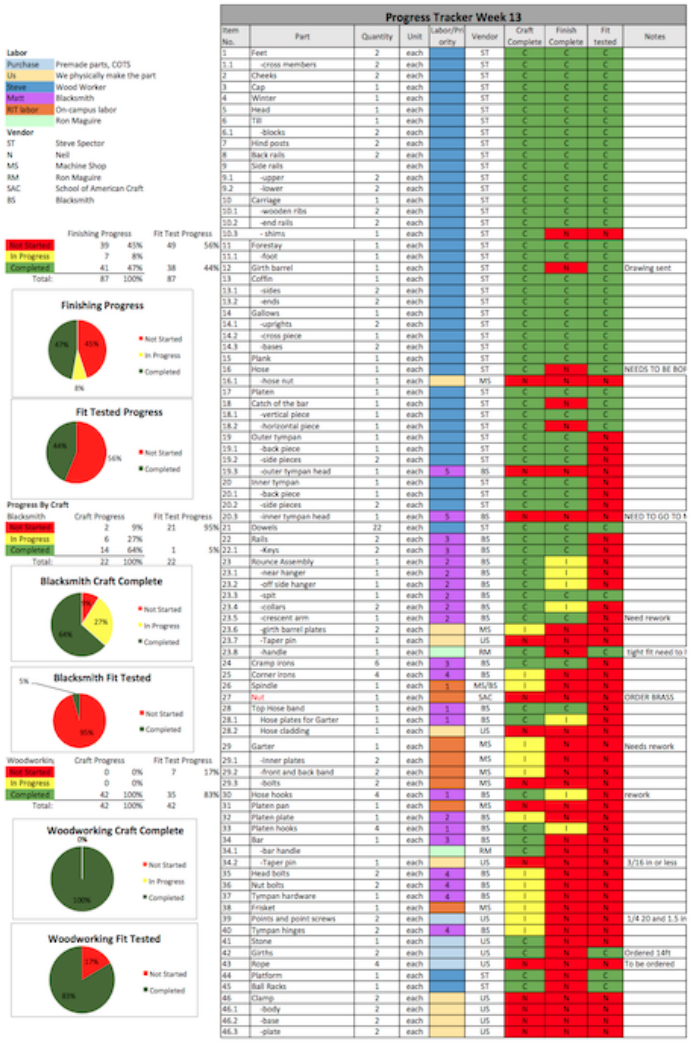

Figure 3: Progress tracker developed by team.

particular part, yellow referred to in-progress, and green meant completed. This tool allowed the team to ensure all craftsmen, including the woodworker, blacksmith, machine shop staff, and team remained on track.

The white oak purchased during the procurement phase of the project was delivered to S. F. Spector about 2 weeks after the start of construction. Due to some issues in the drying process, only some of the wood was usable, and the team had to find additional beams suitable for producing the cheeks of the press. S.F. Spector located salvaged barn timbers in Pennsylvania, but these were too moist to be practical substitutes. Ultimately, after discussing the issue with the Cary Collection staff, the team chose to have S. F. Spector glue-laminate timbers for the cheeks. These were produced in a way that would hide the glue joints as best as possible. Aside from the issues with the cheek material, the fabrication of the remaining wooden parts went smoothly. The wood was hand-scraped with minor sanding by the team and finished with Danish oil to approximate a historically accurate finish.

Metalwork from both the machine shop and blacksmith began immediately at the start of the construction phase. The blacksmith used 1018 low-carbon steel, a substitute for wrought iron, to create parts such as the hose band, hose hooks, rails, and cramp irons. Engineers communicate using engineering drawings, which are part of a very specialized language. One of the challenges faced was translating the information on the team's drawings into a language better suited for production by a blacksmith instead of a modern machine shop. The dimensional tolerances on some parts had to be relaxed, and sometimes the team had to settle for parts that looked "right" even though they didn't match the drawing. Producing metal parts became a conversation, and each side had to give and take. Sometimes, the team used modern shop practices in conjunction with blacksmithing in order to produce satisfactory parts. Parts were outsourced to the machine shop and, after grinding, sanding, and polishing out machine marks, sent to the blacksmith to be blackened for a historic, handmade finish. All metal parts, whether machined or hand-forged, were coated with a mixture of linseed oil, turpentine, and beeswax. This is representative of what might have been used during the eighteenth century.

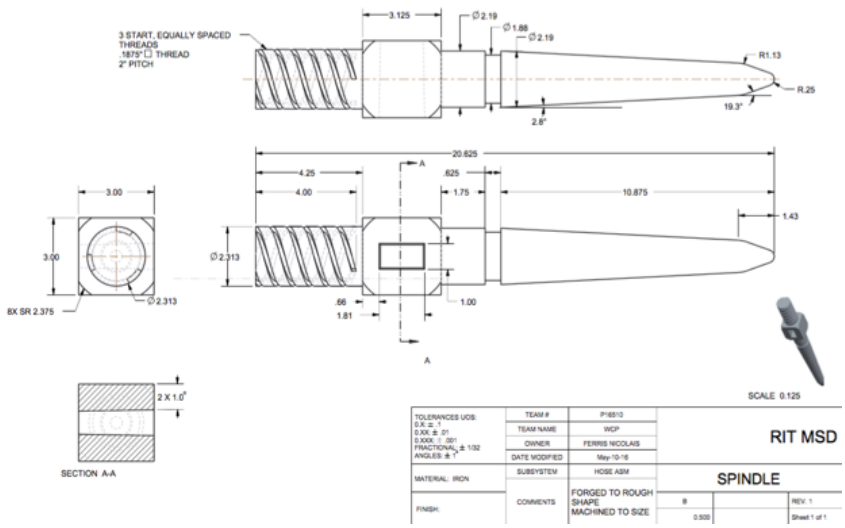

Figure 4: Drawing of the spindle.

The spindle, commonly referred to as the "heart of the press" proved to be the most difficult part to machine within the capabilities of the shop. Figure 4 displays the drawing of the spindle. The three start, two inch pitch thread at the top of the spindle was complicated by available machining capacity. In order to produce the part within tolerance, the threaded section of the spindle was machined, separately and welded onto a turned piece. Initially, the part had a lead time of only 3 weeks; however, it ultimately took 10 weeks to construct.

The press was assembled in only a few hours. Originally, wooden common presses were designed for easy assembly and disassembly for transportability. The team reviewed printer's manuals, such as Caleb Stower's *Printer's Grammar,* to ensure an accurate assembly workflow.

VII. RESULTS

The press currently resides at the Cary Graphic Arts Collection in The Wallace Library at Rochester Institute of Technology. The press is fully functional and is intended to be used by the Cary for demonstrational and instructional purposes. The team was able to satisfy almost all of the customer and engineering requirements initially developed. The press was built with the intent to include all aspects of historical accuracy in design and materials. The design is fully representative of a press that would have been built in the period 1770-1790. The extensive research and feedback presented from printing historians and enthusiasts have confirmed this fact. The materials used are as historically accurate as possible, although some concessions had to be made because of sourcing constraints. The final press stands over 6 feet tall and weighs several hundred pounds. The Cary is incredibly pleased with the newest addition to their collection.

VIII. CONCLUSION

Working with craftsmen to build the press gives a better understanding of what a common press really is. It is a machine, and although it is made of wood it should be treated as such. Although today blacksmiths and woodworkers are referred to as craftsmen, these skilled professionals were the industry of their time. They used the same processes that craftspeople use today, but the intent of their work was more closely aligned with today's manufacturers; namely, to produce a practical object, not necessarily something aesthetic. As engineering students who will soon join today's industry, the team has learned invaluable lessons while working to produce a press from the past.

IX. WORKS CITED

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Moxon, Joseph. *Moxon's Mechanick Exercises: Or, the Doctrine of Handy-Works, Applied to the art of Printing, 1683*.

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