https://doi.org/10.2352/issn.2168-3204.2022.19.1.02

Digitizing and Printing the Burgert Brothers Ledger Books: A Case Study in High-Volume Facsimile Production

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Abstract

The goal of digitization is typically to create digital assets which represent the physical object as a means of digital preservation or access. On occasion, projects require bringing those digital images back into the physical world in the form of a facsimile. While reproducing objects for display and/or use is a common and well-established practice, there are unique cases that require innovative applications of existing tools and methods. Working closely with NEDCC's book conservation lab, we imaged eight ledger books and then printed two copies of each to be rebound into near-identical, usable copies. Using this project as a case study, we will share some of the successes and hurdles we encountered while working through this large volume of material, with particular attention to deviations in image capture and processing workflows when producing bound facsimiles.

Introduction

Tampa Hillsborough County Public Library is home to a significant collection of photographic negatives documenting local history throughout the 20th century. The Burgert Brothers Commercial Photography Studio created an extensive photographic record of the Tampa Bay community through periods of growth and war, as well as scenes of everyday life. This important visual record, in the form of over 20,000 nitrate and acetate negatives, has been digitized to preserve the local heritage and make it accessible to the community. The collection also includes 14 ledger books that serve as an index to the photographic material, detailing the customer, subject matter, and negative number for each photograph.

As these ledger books were considered an equally important component of the Burgert Brothers collection, the Tampa Hillsborough County Public Library requested we digitize the ledger books dated between 1911-1964. The objective of the ledger project, beyond the conservation and digitization of the original record books, was to create usable facsimiles of each volume so that researchers could gain access to their information without further risk of damage to the original material. To this end, our main focus was to create high-quality physical surrogates that would both be representative of the original objects and also hold up to continued use over time.

Since this project was large, given the need to conserve, digitize, and produce two facsimiles each of 14 separate ledgers, the collection was initially split into four groups of 3-4 ledgers over the course of a planned two-year timeline. While work on the first two groups proceeded smoothly, logistical challenges due to COVID closures and restrictions required consolidating the last eight ledgers into a single group with a relatively tight deadline: all eight needed to be fully digitized, printed, and bound in the span of three months, from December 2021 through the end of February 2022. This unexpectedly compressed timeline required evaluation and adaptation of existing workflows so that work could proceed as efficiently as possible while maintaining the highest quality consistent with the previously completed work.

The end goal of creating physical, bound facsimiles introduced complexity throughout every stage of the project. First, the original ledgers themselves presented complications, as each book arrived from conservation treatment in varying states depending on the level of treatment it required. Several ledger books were fully bound while others were completely or partially disbound, each of which required a different approach to image capture. Following image capture, we then had to manage the post-processing of large quantities of files as we worked through multiple complex editing stages for each book. Since we had such a large number of files, it was important to streamline both the post-processing and printing workflows in order to produce the most consistent outcomes. The final challenge we encountered was the printing process itself, which required color matching prints to the original material, verifying print size and alignment, and then further batch processing files to incorporate these color and layout adjustments. Overall, a variety of complicating factors appeared throughout every step of the process, which required us to problem solve quickly and adapt our workflows as we worked through the material.

Previously, our imaging department produced facsimiles for six ledgers, and in doing so we identified some pitfalls in the capture, post-processing, and printing stages. We learned that even minute deviations in the relationship between the object and the camera created enough discrepancy in the resolution that we found it was imperative for us to minimize this variation. Since we were printing two-sided as well as binding 300 or more pages, these variations in resolution would be visually apparent in the final product. For most bound volumes this problem was solved by using our Zeutschel book cradle. We also previously encountered visible gaps between bound material and our printed background. For this final group we were able to anticipate issues like these and through the use of quality control, establish solutions to further streamline our workflow.

Capture

Each of the eight ledgers in this group arrived at NEDCC in a different physical state and received treatment in the Center's book conservation lab. By the time they arrived in imaging, one ledger was completely disbound, two were disbound after being removed from three-ring binders, three were completely bound in the original boards, one was sewn but removed from its original boards, and one was partially disbound (about 150 pages were disbound in groupings while the rest was sewn and attached to the rear board). We decided to digitize all of the volumes on a single workstation to avoid minor color variations that could be introduced by different image sensors. For capture, we chose a 180-degree book cradle (specifically, a Zeutschel OT 180 H A0) because of its ability to accommodate the

wide variety of binding states and minimize deviation in image resolution when imaging the still-bound material.

The eventual goal of creating facsimiles introduced required creative problem solving from the very beginning. For example, NEDCC's standard practice is to capture most reflective material against black velvet fabric. However, we quickly understood that this would be impractical for the final facsimiles. Slight variations in page size, the challenge of achieving perfect alignment when inkjet printing rectos and versos, and the impracticality of hand-trimming every printed leaf meant that text blocks needed to be trimmed in bulk, and a this could lead to awkward black margins around some pages or edges of pages being trimmed off altogether. Further, losses to original pages that did not require filling by the conservation labs would be visually distracting if imaged against a black ground. To remedy these problems, we printed a page-tone background specific to each ledger against which pages from that ledger could be captured. To produce this ledger-specific shooting background, we captured a blank page at the front or back of the ledger under the same conditions as the eventual full digitization, evened out the page tone and removed evidence of staining and accretions in Photoshop, and then printed at enlarged scale on Mohawk Superfine SoftWhite smooth paper (the same as was chosen for all of the facsimile pages), with particular attention paid to replicating both the texture and color profile of the original pages.

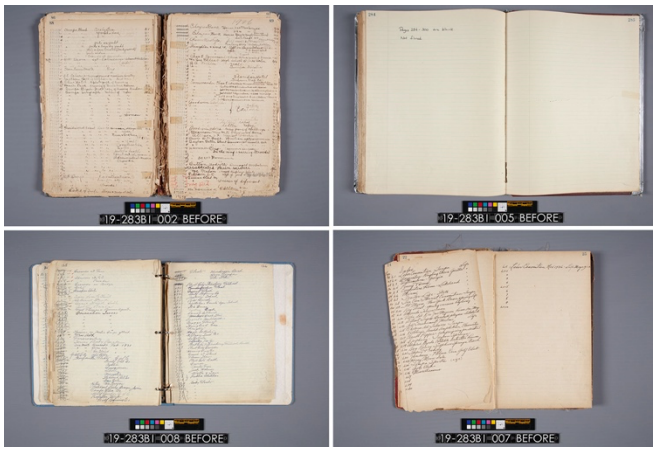

Figure 1. *Before treatment shots that show the varying physical states of the ledgers.*

Completely disbound ledger pages were placed against the custom background page during image capture. Using these custom page-tone backgrounds minimized evidence of page losses and resulted in pages that were much easier to trim after being assembled by the conservator. But for still-bound volumes, simply interleaving the background page would have left voids at the head and tail of each volume near the gutter, which would then appear in the reproductions. To prevent this, background pages for volumes that remained bound were notched on one side to accommodate the binding structure. The notches were cut manually for each bound ledger, allowing the background to fit snugly in the gutter and creating the desired page-tone border around the top, bottom, and fore-edge while extending past the gutter. The background was then interleaved behind each page throughout the capture process. While this approach largely eliminated evidence of the binding in the resulting images, small gaps at the head and tail of the gutter were unavoidable. Recognizing that these would translate into the facsimile pages, and so would need to be addressed in post-processing, care was taken to trim and interleave backgrounds as precisely as possible to ensure the best fit and minimize those gaps.

Accurate scale and consistent alignment were additional concerns for the facsimile pages that, if addressed as much as possible during image capture, would minimize effort at later stages of the workflow. To this end, all material was shot at 600 pixels-per-inch with the same Phase One IQ180 medium format camera system. Golden Thread Object-Level Targets were used during setup to neutralize white balance and check for proper exposure and resolution and monitored throughout image capture to ensure minimal variation from image to image and across the entire volume. The camera was leveled prior to each day of capture to reduce the possibility of camera drift and thus distortion or variation between pages.

Figure 2. *Photographer Sami Wright interleaves the notched page-tone background between the pages of a bound volume during imaging.*

The facsimile pages were to be printed as simple leaves, recto-to-verso, which required each page to be captured individually. For disbound material, the printed background page was temporarily secured to the book cradle's platens and each page was imaged individually, with original folios unnested and unfolded prior to capture. Though NEDCC's book cradle is customized to move laterally along rails so that pages can be efficiently captured in sequence by manually shifting the cradle under the camera, doing so introduced variability in the volume's placement in the frame from shot to shot, which would require additional effort when cropping. It also introduced the possibility of slight changes in leveling or resolution over time, which actually yielded noticeable variation in scale and geometry when translated to double-sided prints of rectos and versos. To avoid any of these problems, the cradle was left stationary and the material itself was rotated after the completion of odd pages to then capture the evens. Keeping the material, camera, and book cradle as static as possible minimized any effect on resolution or overall image quality. Counterintuitively,

but to our advantage, we also found through testing that, because of the interleaving required for each page, isolating this process to one side of the volume, rather than switching from left to right, made capturing the volume more efficient overall.

Once page-tone backgrounds had been printed and cut, and camera equipment set, the shooting process was fairly streamlined, though needs for the printed output continued to impact our workflow. Because the book conservation lab was using an adhesive casebound structure for the facsimiles, a style which results in relatively 'tight' bindings with limited access to the gutter, prints would require an allowance along the gutter to prevent text from being inaccessible in the reproductions. To facilitate this, a minimum 1-inch extension of the gutter was required when framing each page under the camera. A universal frame size was created on capture using the Auto Crop feature in Capture One, which allowed for a visual check after each capture to ensure that material had not shifted and impacted the consistency of the borders.

In general, disbound material was imaged relatively quickly as no interleaving was necessary. Bound material, on the other hand, required much greater time, both because of the interleaving and to avoid shifts in resolution or page alignment. Page counts for the ledgers ranged from 300 to 500 pages, so imaging was completed in the course of one day whenever possible, knowing that doing so would yield greater consistency across all images for a given ledger. The use of the book cradle allowed for the application of gentle pressure to the material during capture, producing the most geometrically accurate image possible. Under these conditions, the material was imaged cover-to-cover, including all blank pages. Thereafter the photographer immediately conducted a visual check for completeness and consistency and completed any necessary re-shoots before moving on to the post-processing stage.

Post-Processing

In post-processing, our main focus was the accuracy of the appearance and alignment of pages. The first stage of post-processing took place in Capture One Cultural Heritage. All pages were cropped to the exact same dimensions and viewed side by side to ensure accurate alignment, which was particularly necessary since all of the volumes contained ruled pages. To determine the proper size of the crop window for each ledger, we identified the largest page that would be part of the printed facsimile, typically the front or back flyleaf. Using this as a reference for our crop window ensured that no page content would be cut off during the paper trimming process.

We consulted extensively with Book Conservation Technician Ned Schultz, the person working on this project in the Book Lab, to determine how much space would be required on the borders to allow for proper trimming and binding of the facsimiles. We determined that .25 inches on the top, bottom, and fore-edge and .5 inches in the gutter would be satisfactory. In Capture One, guides were again used to allow us to visualize the borders for each page. (Please note, through trial and error we realized that the proper resolution must be set in the Process Recipe to ensure that the ratio is correct when using the guides in inches.)

Using the preestablished page as a reference, the crop window was manually adjusted so that each guide met the edge of the page as precisely as possible. Micro adjustments to rotation were made to square the page to the upper and fore-edges. Once the crop window was straight and the guides were in place, these dimensions were applied to the rest of the ledger using the Auto Crop function.

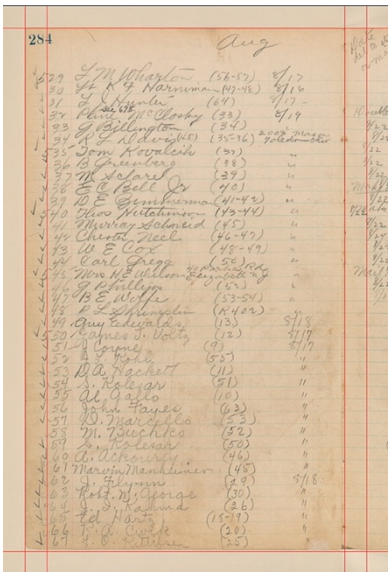

Figure 3. *Guides (in red) were used to ensure each image had consistent borders and gutters to facilitate the later binding process. Guides also served to confirm alignment from page to page, which aided in the printing stage.*

Each individual page still required manual adjustments for alignment and conformance to the crop window. Due to the slight curvature of some of the bound material, and page losses in some of the disbound material, not every page fit fully against all four guides. To minimize these differences, the upper and fore-edge were again used to guide the rotation and alignment of individual pages. For pages with significant losses, alignment was particularly important because we eventually found that any misalignment was evident in these areas when printed. As a final check of the overall page alignment, two-page spreads were viewed side by side in Capture One and examined under magnification to confirm that the alignment of the top edge and ruled lines were as consistent as possible from one page to the next. We also examined the recto-versos of damaged pages next to each other as additional visual confirmation of alignment prior to printing.

The second stage of post-processing was performed in Photoshop. At this time, we addressed any evidence of the binding structure or conservation treatment that would not translate well into a printed facsimile. For example, as a consequence of interleaving the page-tone background behind the pages of the bound material, there were some visible gaps along the top and bottom edges at the gutter. This was addressed by carefully using Photoshop's Clone Stamp tool to restore the edge of the page. Additional 'clean-up' was needed for much of the disbound material that had been significantly repaired by book conservators. The Clone Stamp and Healing Brush tools were used to remove untrimmed Japanese paper repairs that extended off the page. No changes were made to the repairs themselves, only to the paper fibers extending past the edge of the page.

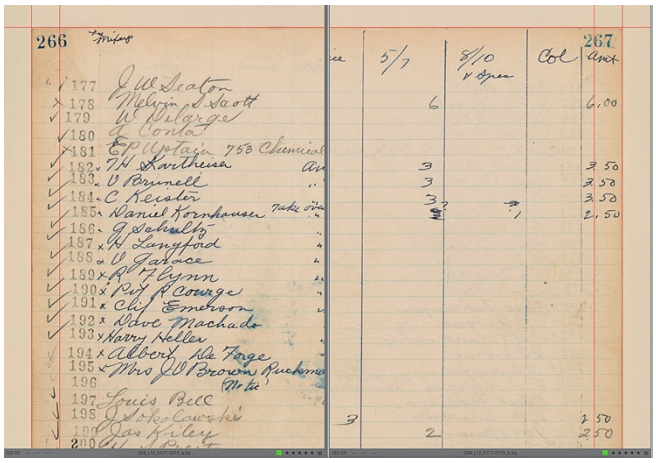

Figure 4. *Spreads were viewed side by side at an increased magnification to confirm the alignment of each page.*

During this stage of post-processing, we undertook some additional manual editing to produce the cleanest images and prints. As discussed above, we had confirmed with the Book Lab that additional printed allowance would be necessary beyond the gutter so that all content was legible with the restricted openings of the facsimiles. Simply extending the crop at the gutter would have given us the neutral paper tone we needed to avoid distraction, but would also introduce text from the adjacent pages in many instances. To get the first without the latter, we utilized the Marquee Tool in Photoshop with a 50px feather to select from the original neutral background image. That selection was then copied onto each image file via a batch action and manually positioned immediately adjacent to the page gutter, ensuring that the entire gutter and page content was unobscured. This neutral gutter served the dual purpose of producing a physical gutter to be used in the binding process of each facsimile while also eliminating text or other visual distractions along that gutter.

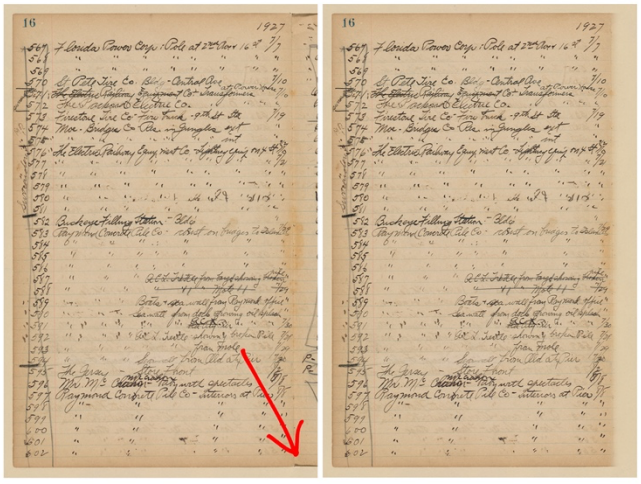

Figure 5. *Small gaps were visible between the edge of the page and the page-tone background in some of the bound material (left). Photoshop was used to drop in a neutral gutter and remove any visible gaps (right).*

Upon completing both stages of post-processing, we proceeded to produce the digital deliverables for each ledger. The Library received Preservation Master TIFs of all unedited images (before any work was done in Photoshop) and Access Derivative JPGs of all edited images. They also received page-level PDFs, produced from the JPGs using a batch action in Photoshop, and additional ledger-level PDFs. All of the Photoshop-edited images were also saved as TIFs for our use in the printing stage.

Printing

While one photographer continued to capture and process files, the other began printing the facsimile pages using an Epson SureColor P900 printer. We used Mohawk Superfine SoftWhite, smooth paper for all of our printed backgrounds, test prints, and final prints. This was recommended by the Book Lab as a paper that would mimic the original paper of the ledger books both physically and visually. Color matching was a thorough process achieved both by relying on relatively objective data and through iterative perceptual matching.

Photoshop was used to make minor adjustments to the tone, color, and lightness so that the visual appearance was as closely representative of the original as possible. Prior to any printing, we began in Photoshop by adjusting levels to correct for any minor variances between the OLT's stated values and the values as-read in our images. In particular, bringing the white and black points into alignment made significant progress towards accurate brightness. From this point forward we proceeded with perceptual color matching. Prints were generated and evaluated against the originals under varied lighting conditions (daylight, D50 fluorescent, and generic LED). Based on the review of these prints, we made further adjustments to the Color Balance layer. While many of the adjustments were made in the midtones of this layer, we found that because of the relatively significant presence of 'page tone' in the images, targeted but slight adjustments to the layer's highlights allowed us to truly 'fine-tune' the visual accuracy of the prints.

Such fine-grained color editing was necessary to achieve consistent accuracy, given the variations between and even within ledgers. For example, many of the ledger books had been heavily used, resulting in visually significant changes in page color from one section of the book to the next. Further, the presence of a variety of pen types and colors, as well as other utensils like pencils caused many subtle but significant differences in something as simple as blue ink. To overcome the color variation within each ledger we used the Selective Color tool to further refine their nuance. These adjustments were largely made in the Neutral channel, but we also made slight adjustments in the Blacks, Whites, and Yellows.

Once we achieved color and tonal accuracy, we generated additional test prints to refine the resolution. We began by printing files at the exact resolution measured during capture, for example, 604 pixels-per-inch. If the resulting prints varied in size from the original when trimmed and placed directly on top of it, we made slight adjustments to the output resolution, never more than +/- 3 pixels, until the print size matched the original as much as possible, though extremely slight variation from print to original was still observed in some instances.

With both appearance and scale matched to the original, we submitted samples to Ned for evaluation with his needs in mind. After we received any rare feedback and final approval from Ned, we finalized the print settings for the ledger. To do so, we ran all files from a ledger through a Photoshop batch action specific to that ledger that applied the volume-specific color and resolution adjustments, a High Pass sharpening filter, as well as the paper

profile and other printer settings. Using software utilities, the image files were divided into dedicated folders for the left and right sides, which increased printing efficiency since all pages had to be fed manually when printing the versos. This allowed us to print a large group of rectos in batches and then flip and manually refeed them into the printer for the verso. Accuracy in color and page alignment was checked with each print as it was generated.

Figure 6. *Photographer Harrison Walker checks for proper page alignment in a printed recto-verso.*

Page size ranged from approximately 10 x 14 to 11 x 17 inches and took between two to three minutes to print each image, which significantly impacted our timeline. To produce all 16 sets of prints—two copies per ledger for eight ledgers—and allow time for Ned to bind them, we set up two printing stations for a period of two weeks (the second printer was graciously lent to us by the conservation labs). The setups were nearly-identical, with both Epson SureColor P900 printers run by their own MacBook Pro using the same print drivers and ICC color profiles. However, one overlooked difference that yielded unexpected problems was a difference in operating systems between the two computers, one with Catalina and the other with Monterey. While the printer run by the Catalina operating system printed almost without fail, the one run by Monterey would occasionally experience a print error: "filter failed." While we might ignore such an error when printing the occasional facsimile of a photograph or blueprint, it presented a significant hurdle when printing at a high volume. While research and troubleshooting never revealed the underlying source of this problem, it was largely resolved by reinstalling the print driver. That said, it seemed to recur after running a large number of prints through the queue, further confusing the source of the problem. Despite this issue, the two-printer setup worked very well to increase our overall print output as it minimized the significant downtime often involved with archival inkjet printing, allowing us to provide Ned with the facsimile prints on a rolling and timely basis.

Covers

While the majority of our time, energy, and creative problem solving was directed towards accurately reproducing the text block, we identified an opportunity to bring these efforts to some of the bindings themselves. After observing that a number of the original ledger's cloth covers featured stylized printing that would otherwise not translate to the facsimiles, we consulted with Ned regarding the possibility of reproducing that printing on the new covers. To achieve this end, the covers (front, back, and, when necessary, spine) were imaged, digitally restored in Photoshop, the background eliminated, and the now-isolated stylized design printed onto book cloth for use when binding the ledgers. This final step required considerable planning and some trial and error to achieve the correct position, alignment, and scale of the printed elements once they were wrapped onto the boards. We used the same buckram book cloth that Ned had originally planned for the covers and printed it on an Epson 9900 so that the cloth could remain flat when feeding in and out of the printer. We found that using the Plain Paper setting minimized ink output, which was well-suited for the relatively less absorbent book cloth. The conservator applied a spray fixative sealant after the ink was cured for several days to ensure that the ink would hold up to regular use without fading.

Figure 7. *A comparison of facsimiles with new covers (left and right) and original ledger (pictured during re-backing, center).*

Quality Control

Consistency and efficiency were extremely important for us to meet the project deadline and produce high-quality facsimiles. To ensure we met these standards, quality control was conducted at each stage. After each ledger was captured, the other photographer would review each image file ensuring that there was no missing content, that pages were consistent in tone and color, that alignment was accurate and consistent, and that the filenames were correct. Once we were confident in the quality and completeness of each ledger's files, we began prepping the files for print. During the printing process, each page was checked for alignment of the recto and verso, that pages were consistent in color and tone, and that there were no artifacts or blemishes produced during the print process.

Although we did an initial quality assurance of the digital assets prior to printing and reviewed each print as it was generated, one final quality control pass was performed after each ledger was completely printed. Working closely with the conservator we were able to ensure that each ledger was not missing content and that the

prints produced would align with the expectations of the conservator undertaking the binding process. Layering in multiple stages of quality control allowed us to more easily and quickly identify if and when something was off or inconsistent. This also facilitated an efficient and effective workflow, helping us to meet the deadline.

Figure 8. *Comparing scale and color accuracy between print reproduction and original.*

Conclusion

Using the above-outlined workflow, which was adapted from work completed on the previous two groups and continually improved upon throughout our own process, we were able to successfully complete this project within the constrained timeline. Over the course of this final group of eight ledgers, we produced 6,950 digital files (including JPGs, TIFs, and PDFs) and 4,532 printed pages across all 16 facsimiles. Working closely with the Book Lab and one another, we delivered completed prints on a rolling basis, which allowed for imaging, printing, and binding work to all occur concurrently across the three-month timeline. In light of this large-scale reproduction effort, which specifically involved a number of bound volumes in varied conditions and states, we were required to near-fully reinvent our approach to imaging the materials, and then to continue adjusting that approach based on the individual volumes themselves and the lessons learned throughout.

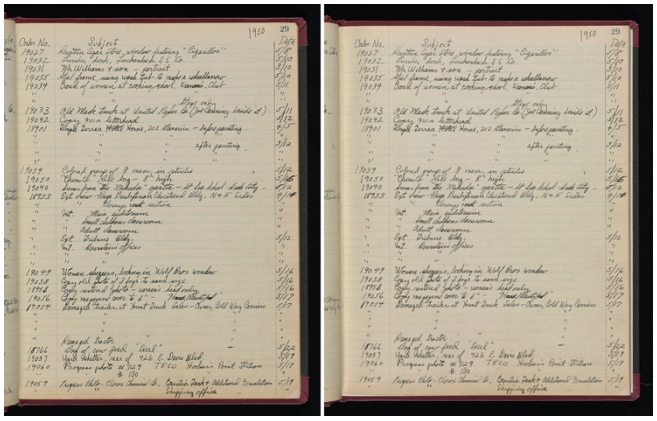

Figure 9. *A side-by-side comparison of the original ledger (left) and the completed facsimile (right).*

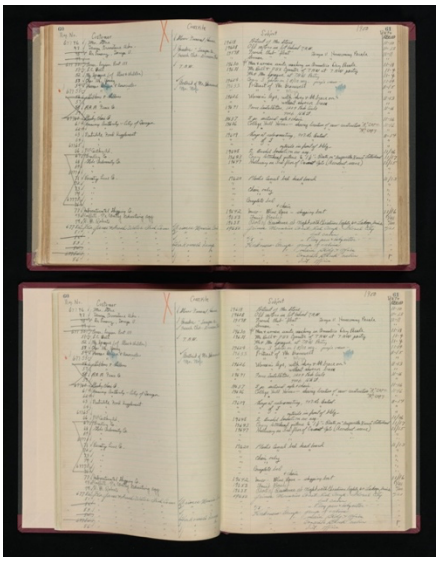

Figure 10. *A comparison of the original ledger (top) and the completed facsimile (bottom).*

While NEDCC frequently produces facsimiles for organizations, these are typically structurally simple objects, whether photographs, maps, or documents. And even though we have reproduced bound volumes previously, these efforts were undertaken for a single object, which allowed for considerable pre-planning but also limited opportunities for evolving workflows to incorporate improvements. As such, this was the first project of its kind—a large-scale book reproduction project—that we have completed. We hope that sharing our approach to this unusual project and the lessons that we learned will illuminate potential problems and offer possible solutions for others.

Acknowledgments

Special thanks to Ned Schultz for all of his incredible conservation work on the original ledgers and beautiful bindings for the facsimiles. We would also like to thank Chloe Schoppmeyer for all of her work on the first three ledgers. Finally, we would like to thank our colleagues in the NEDCC Imaging Department for all of their support throughout this endeavor.

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