

EXAMINATION AND TREATMENT REPORT FOR A CARPENTER & CO. LOCK FOUND AT SERC

MUSEUM CONSERVATION INSTITUTE #6955

CAROL A. GRISSOM, SENIOR OBJECTS CONSERVATOR

X-Radiography by E. Keats Webb, Imaging Specialist

X-Ray Fluorescence Analysis by Thomas Lam, Physical Scientist



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28 November 2020
(Revised 4 June 2021)

Prepared at the Request of Anson “Tuck” Hines,
Director, Smithsonian Environmental Research Center



Smithsonian
Scholarly Press

WASHINGTON, D.C.
2021

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Executive Summary

An aged and heavily corroded horizontal iron rim lock for the left side of a door was examined at the request of Anson (“Tuck”) Hines, Director of the Smithsonian Environmental Research Center (SERC). The lock was reportedly found by a contractor on SERC’s property during renovation, and the iron corrosion is typical of exposure to the elements. It was anticipated that the lock would date from the time of the oldest part of the Sellman/Kirkpatrick-Howat house constructed in 1735 or its Greek Revival enlargement in 1841. Examination of the lock, which included x-radiography, identified three bolts: a quarter-round pivoting latch with up-and-down movement, a large rectangular sliding bolt, and a square sliding night bolt. The large size and weight of the lock suggested that it would have been employed on an important door, and the night bolt indicated that it would have been mounted on the interior surface of the door.

A priori, it seemed likely that SERC’s lock was made in England because of its domination of manufactured locks until at least the mid-1830s in the United States. X-radiography further suggested that a disk on the front of the lock was a patent seal identifying it as a Carpenter-type lock made in the English Midlands. Following x-ray fluorescence identification of the seal’s metal as brass, removal of grayish white corrosion products on the surface was proposed, approved, and completed. This revealed the royal arms of England with the royal motto “DIEU ET MON DROIT” below and “CARPENTER & CO • PATENTEE” around the perimeter, confirming that the lock was made by James Carpenter in the Borough of Wolverhampton, England. English patent 5880 was received for a lock by James Carpenter and John Young on 18 January 1830. This provides a date of manufacture *post quem* for the lock, and the death of James Carpenter in 1844 provides a date *ante quem*. Hence, the lock was almost certainly installed around 1841 during construction of the Greek Revival portion of the house.

Through an “Historic Structure Report” for the house, it was subsequently discovered that the Greek Revival part of the Sellman house retains in situ no fewer than seven Carpenter locks of different sizes, employed according to a hierarchy of size correlated with importance of the door. The corroded lock’s size is smaller than those on front and rear doors but the same as the door to the largest bedroom, thought to be the master bedroom of Alfred Sellman, who had the Greek Revival portion of the house built. Evidence on the door and door surround of a small bedroom on the second floor adjacent to the master bedroom shows that it was installed there. A later nineteenth-century Russel & Erwin lock is currently on the door, but the original keyhole and cuts for installation match the corroded Carpenter lock and same-sized Carpenter lock on the master bedroom door. Of four smaller locks of the same size, one is on a large second floor bedroom, and three on third floor (garret) bedrooms.

A recommendation was made that the lock not receive further conservation treatment, such as removal of iron corrosion, because it would threaten the structural integrity of the object. Instead it was advised that the lock be exhibited in a case with conditioned silica gel and regularly monitored, which should keep it in stable condition.

Particulars of the Project

Object:	A large horizontal Carpenter rim lock for the left surface of a door
Provenance:	Found by a contractor on the grounds of SERC in Edgewater, Maryland
Manufacturer:	[James] Carpenter & Co., Willenhall (Borough of Wolverhampton), England
Date:	Probably ca. 1841, when the Greek Revival portion of the house was built, along with seven other Carpenter locks in the house; consistent with the lock's patent seal for English patent 5880 received in 1830 by James Carpenter and John Young and Carpenter's death in 1844
Materials:	Principally iron; brass hub, patent seal, night bolt slide, and washer
Dimensions:	Estimated original case (w/o flange) – H 4¾ in (12.1 cm), W 7 in (17.8 cm), D 7/8 in (2.3 cm). Lock including corrosion and flange – H 5½ in (13.9 cm), W 7 7/8 in (20 cm), D 1¾ in (4.5 cm). Weight – 1369 g.
Inscriptions:	“CARPENTER & CO • PATENTEE” around the rim of the patent seal; the royal motto “DIEU ET MON DROIT” on a ribbon at the base of the royal arms of England
Request:	Assistance with determination of the date of the object, probably 1735 or 1841 (dates of two structures at SERC) through examination and x-radiography
Purpose of request:	Information for exhibition of the lock in SERC's display space in the Sellman House and advice about its preservation
Requestor:	Anson “Tuck” Hines, Director, SERC, 647 Contees Wharf Road, Edgewater, MD 21037; tel: 443.482.2208; email: hinesa@si.edu

Background

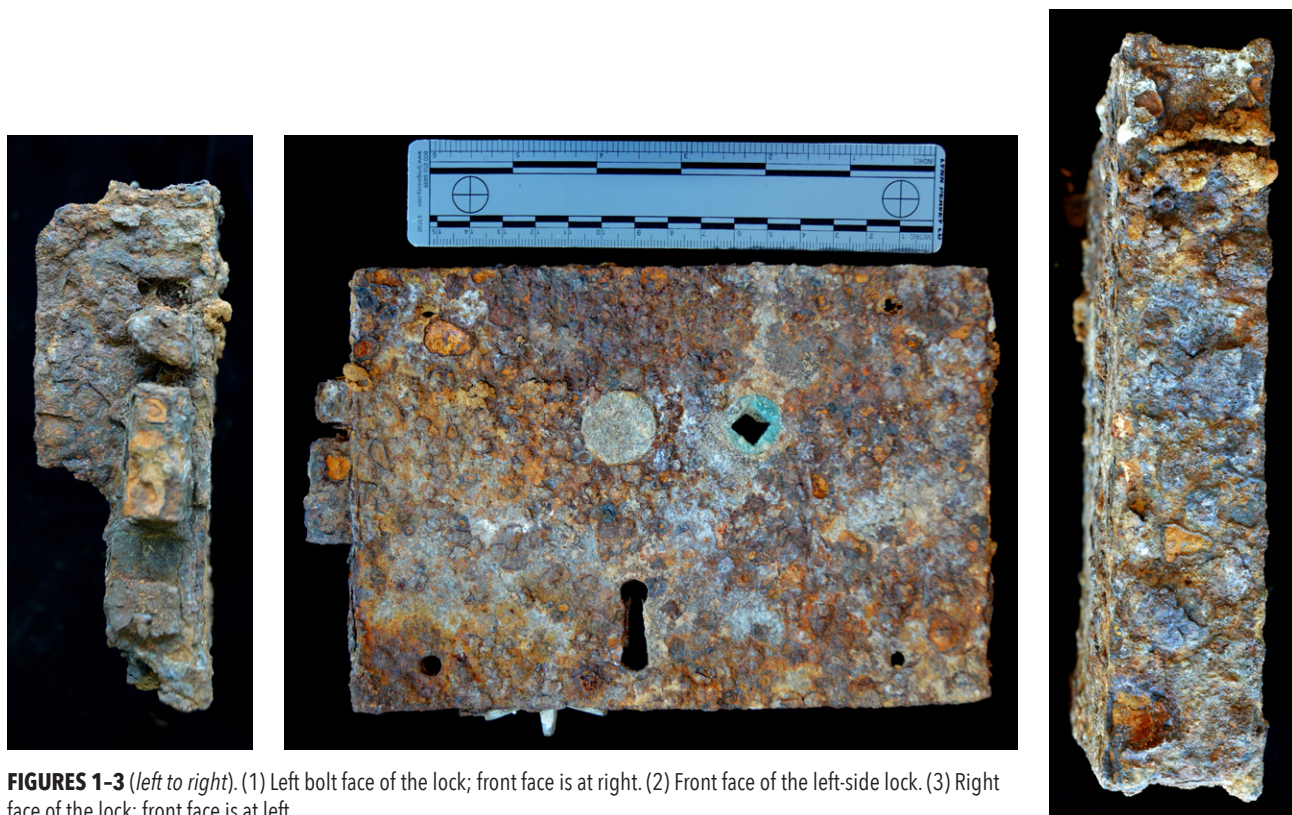
Following the finding of the lock by a contractor on the property at the Smithsonian Environmental Research Center (SERC), Director Anson “Tuck” Hines emailed Museum Conservation Institute (MCI) Deputy Director Paula DePriest the following day, on 28 September 2020: “we need to determine the features of this lock and how to conserve it – a rusted hunk of metal . . . that may be one of the few remaining pieces of hardware from the oldest standing building in SI.” James Gibb, SERC’s archaeologist, was also involved in the project.

The lock was delivered in a plastic bag to the author at the Smithsonian’s Museum Support Center on 30 September 2020 by Christine Dunham, Program Manager, Office of the Directorate, SERC. Examination and photography began that day, and x-radiography was performed by E. Keats Webb on 1 October 2020 (see Appendix A). For temporary storage at MCI, the lock was placed in an archival box with conditioned silica gel to keep it dry; corrosion shed by the lock during examination was collected in a plastic bag. X-ray fluorescence (XRF) analyses of the seal and slide were performed by Thomas Lam on 21 October 2020, which confirmed that they were made of brass and could be cleaned (see Appendix C).¹ After permission was received from Anson Hines on 22 October 2020 for removal of corrosion from the patent seal to reveal its design and lettering, treatment was performed by the author from 26 to 29 October 2020. The lock was picked up for return to SERC by Dunham on 24 November 2020.

Examination

The horizontal iron rim lock was made for installation on the left side of a door hinged on the right. Its plain rectangular shape suggested manufacture in the nineteenth century or possibly earlier, and its large size and weight indicated that it would have been on an important door. It would have been attached on an interior surface because of a night latch, which safeguarded persons in that space, especially during the night. Thick iron corrosion typical of exposure to the elements obscures most surfaces, making it difficult to see details of fabrication, but visible features are consistent with literature on Carpenter-type locks, which inform this report.² X-radiography shows that considerable iron remains based on the metal's greater density to x-rays compared to iron corrosion; nonetheless, corrosion appears to keep the lock intact.

The lock case is made principally of rolled iron sheet (Figs. 1–6) except for raised edges of top and bottom faces, which were “swedged or drop-forged iron in a modified U pattern”; bolts and other workings were “machined iron.”³ Based on the blue-green color of corrosion products, the hub for insertion of the handle spindle and a washer are identified as brass. Accretions atop a patent seal on the front and a slide on the lower edge are instead grayish white, but x-ray fluorescence analysis performed by Thomas Lam confirmed that they are made of brass, consistent with other Carpenter-type locks (Appendix C).⁴ Lam also found calcium in both areas, but only mild effervescence from evolution of carbon dioxide was observed when acetic acid was dropped onto a sample, indicating that only a small amount of calcium carbonate is present. Rather, most of the grayish white material probably consists of zinc corrosion products dissolved from the brass (an alloy of copper and zinc), which are white and typically consist of zinc oxides and/or zinc carbonates. It remains a puzzle that the material on the seal is not tinged green like the hub and washer, as is usual for exposed objects containing copper.



FIGURES 1-3 (left to right). (1) Left bolt face of the lock; front face is at right. (2) Front face of the left-side lock. (3) Right face of the lock; front face is at left.

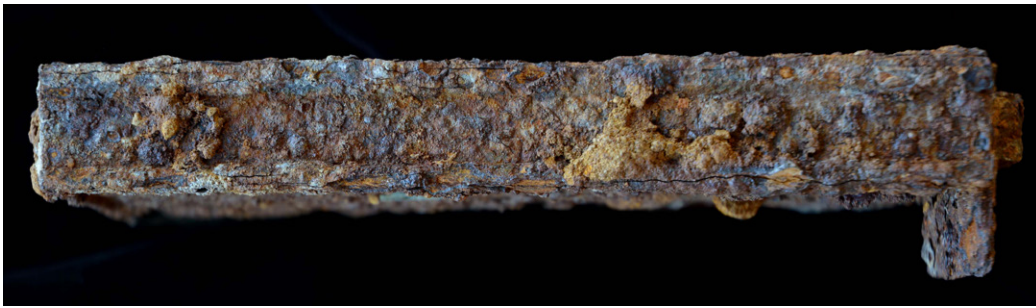


FIGURE 4. Top surface of the lock; back face is below, extended upper bolts are at right, and the flange is at lower right.



FIGURE 5. Back face of the lock; flange and extended upper bolts are at right.



FIGURE 6. Bottom surface of the lock; back is face uppermost. The brass slide at right locked the night bolt (now inside the case, visible below the gap at the upper right) when moved to the right. The flange is in the background, at upper right.

The front face of the lock case is made from a flat rectangular sheet, perforated by round holes at each corner for attachment to the door. Part of a threaded screw and a portion of a brass washer can be seen near the lower right attachment hole in x-radiographs (Fig. 7, Appendix A). Subsequent to radiography, the threaded piece detached and rattled inside the lock when handled. Its threaded shank with the brass washer stuck to its middle by corrosion could be seen at the keyhole, but the ensemble proved too large to fit through the keyhole for removal. The keyhole (1 inch in height) is located left of center near the lower edge. The $\frac{3}{4}$ -inch diameter brass patent seal is above the keyhole and slightly to the left. To the right of the seal is the round $\frac{3}{4}$ -inch diameter brass hub; its square aperture in the center was for insertion of a $\frac{1}{4}$ -inch-wide spindle, to which brass door knobs would have been attached.

The once-removable flat back of the case is inset slightly below the edges of the four faces surrounding it (Figs. 4–6). Square iron posts visible in x-radiographs just beyond attachment holes toward the center probably served to seat the back in position (the one at the lower left also served as a stop for the night bolt), although their principal purpose was for riveting top and bottom faces to the front.⁵ Two radio-dense circular areas visible in x-radiographs along a diagonal from lower left to upper right probably represent bolts that secured the back to the front, based on similar locations on other Carpenter-type locks.⁶ Bolt heads cannot be seen on the back surface or in x-radiographs, but they might only be visible in radiographs taken parallel to the front and back surfaces, and x-radiographs were only taken perpendicular to the lock. A thin flange extends $\frac{3}{4}$ inch backward from the bolt face to fit against the side edge of the door, while other features appear the same as on the front: the four holes at corners for attachment of the lock, the keyhole, and brass hub.

Both left and right faces of the lock (Figs. 1, 3) are “a continuance of the sheet-iron face bent at right angles,”⁷ and both are sandwiched between top and bottom faces (Figs. 4, 6). The left bolt face now appears thinnest of the four side faces, perhaps because of greater corrosion reflected in x-radiographs (Fig. 7, Appendix A). The flange covering the edge of the door begins just below the top face and must have extended $4\frac{1}{4}$ inches to just above the bottom face, but the lower portion has been lost (Fig. 1). Apertures on the bolt face allowed the exit of three bolts from the lock case, and the two uppermost bolts now extend beyond the case in locked positions. The topmost bolt (quarter-round in profile, measuring $\frac{1}{2}$ inch \times $\frac{3}{8}$ inch) is a lever-type latch; a gap just above it on the bolt face (now filled with corrosion), allowed it to pivot up and down in accordance with open and closed positions. In the middle is the largest bolt (rectangular in profile, measuring $\sim 1\frac{1}{8}$ inch \times $\frac{1}{2}$ inch), which provided the main locking when thrown. Near the bottom corner is the third bolt (square in profile, measuring $\frac{3}{8}$ inch \times $\frac{3}{8}$ inch), which remains with its tip just inside the case. It can be seen in x-radiographs as well as with the naked eye because of the gap on the bottom, seen at right in Figure 6. This is a night bolt, which was worked by moving the tab on the slide on the bottom surface to the left when mounted (Fig. 2).

Top and bottom faces of the lock (Figs. 4, 6) are thicker at edges than side faces (Fig. 5), producing a u-shaped pattern best seen in profile in images at top and bottom of side faces (Figs. 1, 3). The extra thickness would have strengthened the lock, and on the bottom surface, the thicker rims also provided a track for the night bolt slide. On the back, top and bottom faces appear thicker than side faces (Fig. 5), consistent with their density to x-radiographs.

X-Radiography

The lock case and its works can be clearly seen in an annotated x-radiograph reproduced as Figure 7 (see also Appendix A for the range of exposures). At first, corrosion products on the patent seal above the keyhole failed to reveal an expected inscription or design (Fig. 7), and the x-radiograph appeared to show only a round radio-dense center related to its attachment to the case. An ovoid feature at the center was observed with the naked eye (Figs. 8–9), but enlargement of the x-radiographic seal still could not be interpreted (Fig. 10). An online search of similar Carpenter-type locks, however, turned up an image of a Carpenter and Tildesley lock with a similar ovoid feature (Fig. 11).⁸ Comparison to the x-radiograph of SERC's seal seemed to show good correspondence to other features, including lettering around the perimeter, portions of a rampant lion at left and a unicorn's torso and curly tail at right. More importantly, these details indicated that the patent seal would be legible if corrosion were removed. As it turned out, cleaning revealed a slightly different Carpenter seal (Fig. 12): its lettering instead reads "CARPENTER & CO • PATENTEES," and the royal arms of England exhibit slight variations from the Carpenter and Tildesley seal.¹⁰

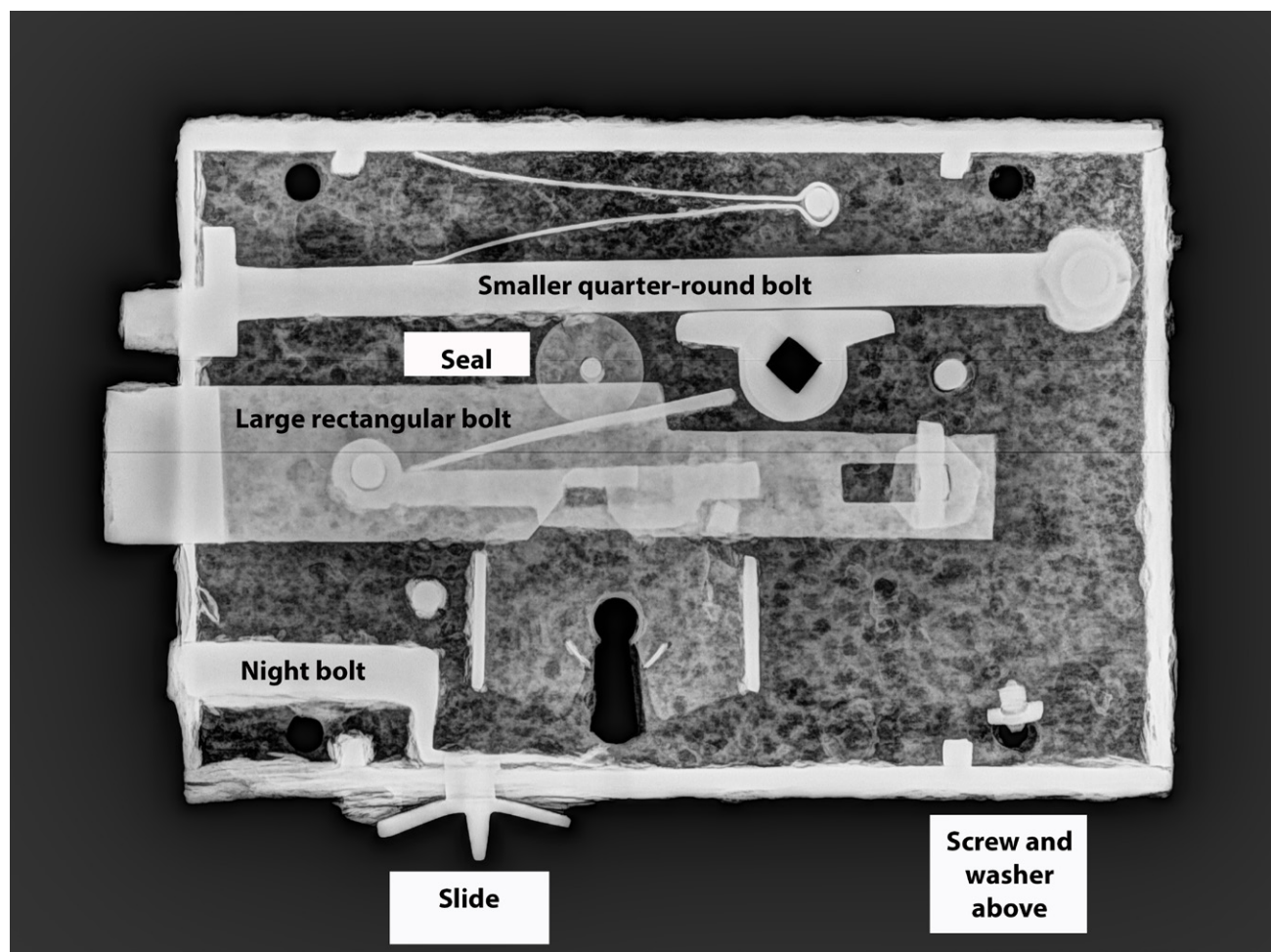
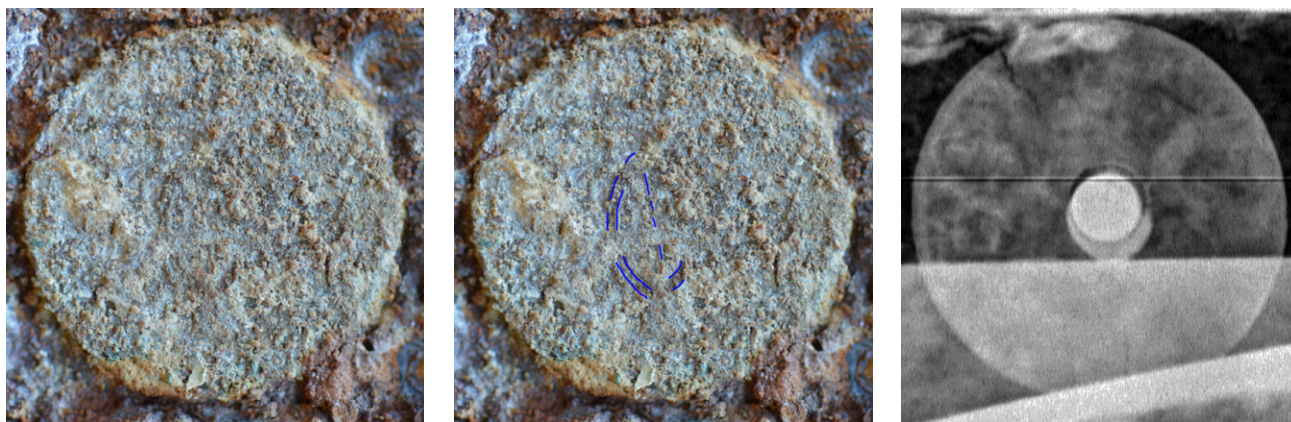


FIGURE 7. Annotated lock x-radiograph (482_SERC_lock_fl) by E. Keats Webb, oriented to conform to the front face.



FIGURES 8-10 (left to right). (8) Detail of SERC's patent seal before cleaning. (9) Same as previous, the central feature outlined. (10) Detail, x-radiograph of previous, showing parts of the lion at left and unicorn at right.

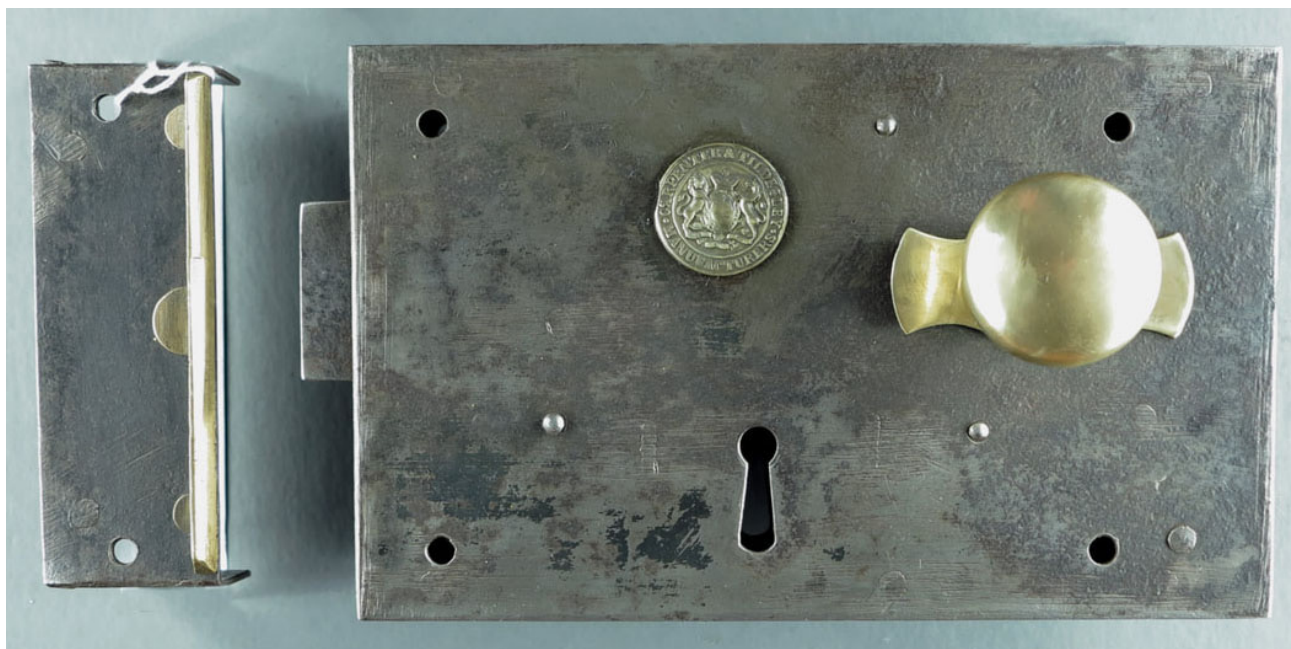


FIGURE 11. Lock with a Carpenter and Tildesley patent seal.⁹



FIGURE 12. Detail of SERC's patent seal after cleaning.

Other attributes of the case and especially its works are visible in x-radiographs (Fig. 7, Appendix C). Round spaces left by the four holes for attachment of the lock are sharp, and the screw remnant and its copper alloy washer can be seen nearly in place at the lower right corner hole. Attachment posts are visible with slight gaps between them and adjacent top and bottom faces at other exposures shown in Appendix C, but rivets are not apparent. Keyholes on both faces present sharp outlines; greater radio-density around circular upper parts of the keyholes is almost certainly reinforcement of a critical region expected to be worn by key usage. A large area around the keyhole also appears to be reinforced by iron sheet, probably stiffened and/or attached at a pair of radio-dense verticals at its edges. A pair of canted radio-dense lines near the keyhole may be associated with wards matching those of a warded key. When the key engaged the wards and turned, the rectangular bolt moved to its locked or unlocked position. As noted above, the pair of dense circular areas more-or-less on a diagonal between the lower left and upper right almost certainly represent bolts that attached the back face to the front. The smaller quarter round bolt and night bolt are radio-dense throughout, while the larger rectangular bolt has such density only on the portion at the left end. Its thinner shank was almost certainly to provide space for other lock elements in front or behind it, such as the spring bolt and wards.

From the x-radiograph of the lock's works, one can ascertain how the lock operated. Starting at the top, the quarter-round latch was held in place by a two-legged spring above it when in its present closed configuration. When the handle was turned clockwise, the rotation of the hub would force it to pivot upward, and it would then be unlocked. The up-and-down motion of the latch is characteristically English (cf. Figs. 13, 14), contrasting with American latches that moved in

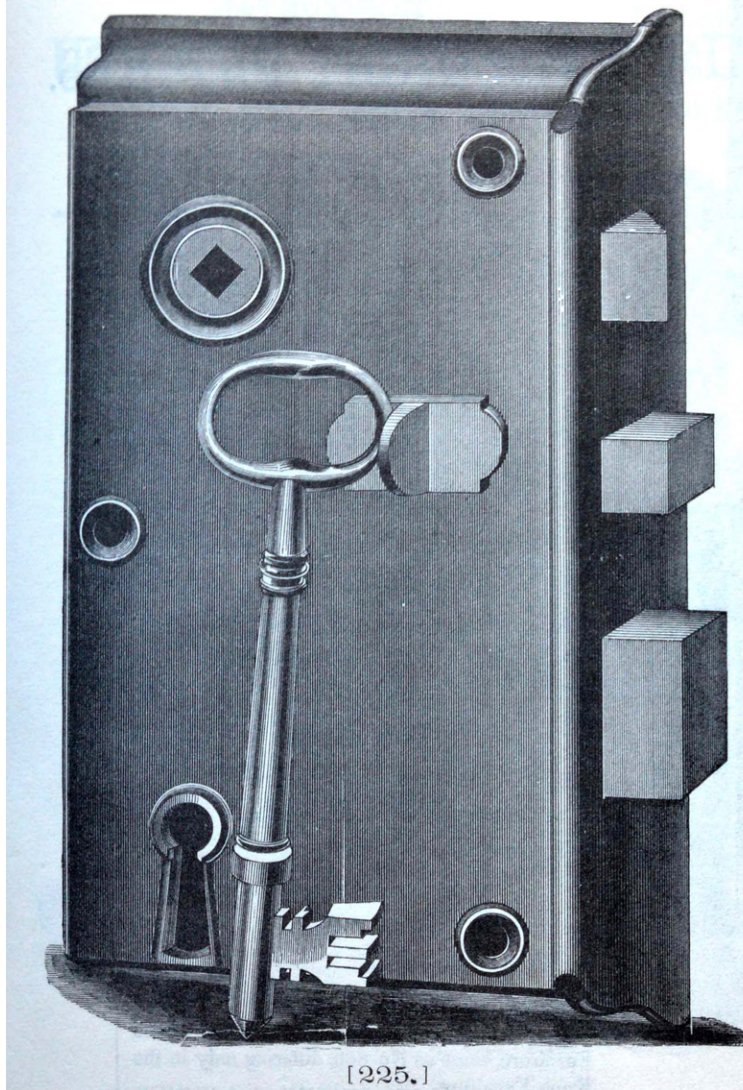


FIGURE 13. Brass rim lock, late eighteenth-early nineteenth century, made by Clement Hardwick and Thomas Newman in England. The slide at the bottom surface of the lock and the aperture allowing up-and-down movement of the latch are similar to those on SERC's lock.



FIGURE 14. Brass rim lock patented by James Carpenter and John Young, 1830–1844. A gap above the latch allowing up-and-down motion can be seen at right, and a detail of the Carpenter seal on the keeper at upper right.

and out (Fig. 15). In the middle, a spring lever parallel to and in front or behind the large rectangular bolt kept the bolt in locked position until the key was turned. The bolt would slide rightward to its unlocked position when a key was inserted in the keyhole and turned clockwise, engaging wards and a notch in the middle of the bolt's shaft. This bolt and the smaller quarter-round bolt above it appear to be those referred to in the 1830 patent for "improvements in the construction of locks, by combining in the same lock a sliding bolt and a lever springbolt."¹² The night bolt at the bottom, now inside the case, was activated by pushing the brass tab on the slide on the outside to the left. A gap between rims on the bottom face allowed the slide to move, and the L-shape of the bolt was stopped in locked position by the post on the interior. Even someone with a key would thus be unable to enter the room when the bolt was thrown. A similar slide in brass can be seen on the English rim lock made by Clement Hardwick (active 1770 to 1817) at Wolverhampton (Fig. 13), as well as on Carpenter-type and other nineteenth-century locks.¹³

**No. 224.**SIZE $7\frac{1}{2} \times 5$ INCHES.

O. G. Case, 3 Wrought Iron Tumblers, Brass Hub, 2 Brass Bolts, Brass Key, Case similar to Lock No. 225, $2\frac{1}{2} \times 2\frac{1}{4}$ inch Knobs on Plain Spindles.

No. 225.SIZE $7\frac{1}{2} \times 5$ INCHES.

O. G. Case, 3 Wrought Iron Tumblers, Brass Hub, 2 Brass Bolts, Extra Brass Night Bolt, Brass Key, $2\frac{1}{2} \times 2\frac{1}{4}$ inch Knobs on Plain Spindles. (See Plate.)

FIGURE 15. Heavy upright rim knob lock for front or outside doors without night keys No. 225.¹¹ It has an American-type in-and-out latch at the top, an "Extra Brass Night Bolt" in the middle, and the main bolt at the bottom; and the case appears to have been cast.

Discussion

The patent seal on SERC's corroded Carpenter lock identifies it as one of many English-made locks that dominated the lock business in the United States during the eighteenth century and up to the mid-1830s and beyond during the nineteenth century.¹⁴ Specifically, lettering on the seal and the reference to the patent identify the lock as made by James Carpenter between 1830, the year the patent was granted, and 1844, the year of his death. Carpenter-type locks continued to be produced well into the latter half of the century, mainly for export. In contrast to the brass Carpenter lock case shown in Figure 14, the cases of most Carpenter locks are plain iron boxes relieved by brass knobs, hubs, and patent seals. The oval escutcheon plate around the keyhole on the opposite face of the door would also have been made of brass and the keeper on the door surround of iron with decorative brass work reinforcing its bolt-receiving edge.

After the lock report was submitted, the author was apprised of an "Historic Structure Report" for the Sellman house, which records the retention in situ of a remarkable seven Carpenter locks ranging in size according to importance of the location. The front door lock is the largest at 6 × 9 inches and the rear door next at 5½ × 8 inches, followed by the door to the largest bedroom (thought probably to have been the master bedroom of Alfred Sellman) at 4¾ × 7 inches, which is the same size as the corroded lock. Four smaller locks measure 4½ × 6 inches and are found on another large bedroom on the second floor and the small garret bedroom, front garret bedroom, and its connecting door to the back bedroom on the third floor.¹⁵

This lock had to have been on a relatively important room, because it is the same size as the master bedroom lock, and evidence on the door of an adjacent second-floor small bedroom shows that it was originally installed there.¹⁶ A later American-made Russell & Erwin lock currently on its door (Figs. 16, 17) is smaller than the corroded Carpenter lock and has a much shallower lip on the side of the door than the ¾-inch flange of the Carpenter lock. Its hub and keyhole are also essentially at the same level, in contrast to the corroded lock on which the keyhole is several inches below the hub (Fig. 2).¹⁷ In order to install the newer lock with handles in the same place, the lock was raised slightly, and the side and keyhole were recut. The bottom of the original keyhole was filled in during recent repainting, but it is partly visible below the lock in Figure 17, which was taken beforehand. Wood can also be seen on the face of the door behind the lower part of the new key aperture at the bottom of the original oval escutcheon plate, where it was incompletely cut out (Fig. 18). Most original cuts remain on the door surround for the keeper (Fig. 16) and on the side of the door for the lock (Fig. 19), and the dimensions match cuts for the keeper and lock (Fig. 20) on the master bedroom, as well as the dimensions of the corroded lock. Later cuts were more crudely done than original ones for the Carpenter lock. The gap below the keeper is particularly noticeable, because the molding is interrupted (Fig. 16). Finally, the bottom cuts on both the side of the door and the molding of the door surround match those of the same-sized lock on the master bedroom at ~32 inches from the floor.

Other possibilities for the location of the lock were ultimately rejected. One hypothesis was that the corroded Carpenter lock might have originally been on a salon door and discarded if the silver-plated mortise locks in the salons were installed in a subsequent upgrade. This could have accounted for brass portions of the relatively plain, more old-fashioned Carpenter locks on front and rear doors having been silver-plated to make them less discordant with more fashionable mortise locks in the adjacent rooms. Analyses and examination showed that both types of locks were close plated with the same silver foil applied with lead/tin solder, thus almost certainly at the same time by the same craftsman.¹⁸ The hypothesis was ultimately rejected, however, because of the declining fortunes of the Sellman estate after the death of Alfred Sellman in 1854 and the beginning of the Civil War.¹⁹ Silver-plated mortise locks are also said to be not inconsistent with an 1841 date.²⁰



FIGURE 16. Small bedroom Russell & Erwin lock currently on the door of the small bedroom (25 June 2021). Note the gap in the molding below the keeper at left, which reflects the larger size of the original Carpenter lock keeper.



FIGURE 17. Small bedroom lock image 3.182 from the 2017 Historic Structure Report, showing part of the original keyhole for the Carpenter lock below it.



FIGURE 18. Front of the door of the small bedroom, showing the original brass escutcheon plate around the keyhole, which has been incompletely recut to match the later Russell and Erwin lock, leaving wood at the bottom of the keyhole.



FIGURES 19-20 (left to right). (19) Side view of the Russell & Erwin lock on the small bedroom, showing earlier cuts for the Carpenter lock at the bottom and side. Although the Russell & Erwin lock is smaller, its configuration required that it be placed slightly higher, as can be seen by its position relative to the tongue of the rail when compared to that of the lock in the following figure. (20) Side view of the same-sized Carpenter lock on the master bedroom door as the corroded lock.

The connecting door between the master bedroom and adjacent bedroom also seemed a possibility for the original location of the corroded lock, but the door, its surround, and threshold are not contemporary with 1841 construction.²¹ Doors in the rear hallway to the kitchen and basement were excluded because they open on the wrong (right) side for the lock. An exterior north door to the “kitchen” of the 1735 portion of the house has its lock on the left side but was rejected because the height of the lock is larger than its lock rail.²²

Condition of the Lock

Thick iron corrosion covers much of the lock, and it actively flakes off, especially with handling. Below the slide, iron's bimetallic corrosion by the more noble brass of the slide is so strong that it apparently deformed the tab. An x-radiograph taken at higher kV (Fig. 21) indicates likely losses on the bolt face and bottom surface that would result in displacement of the night bolt and probably the large rectangular bolt. Fortunately, the lock can be kept stable in a dry environment conditioned with silica gel. It should be handled with care: the flange in particular is thin and vulnerable to further breakage.

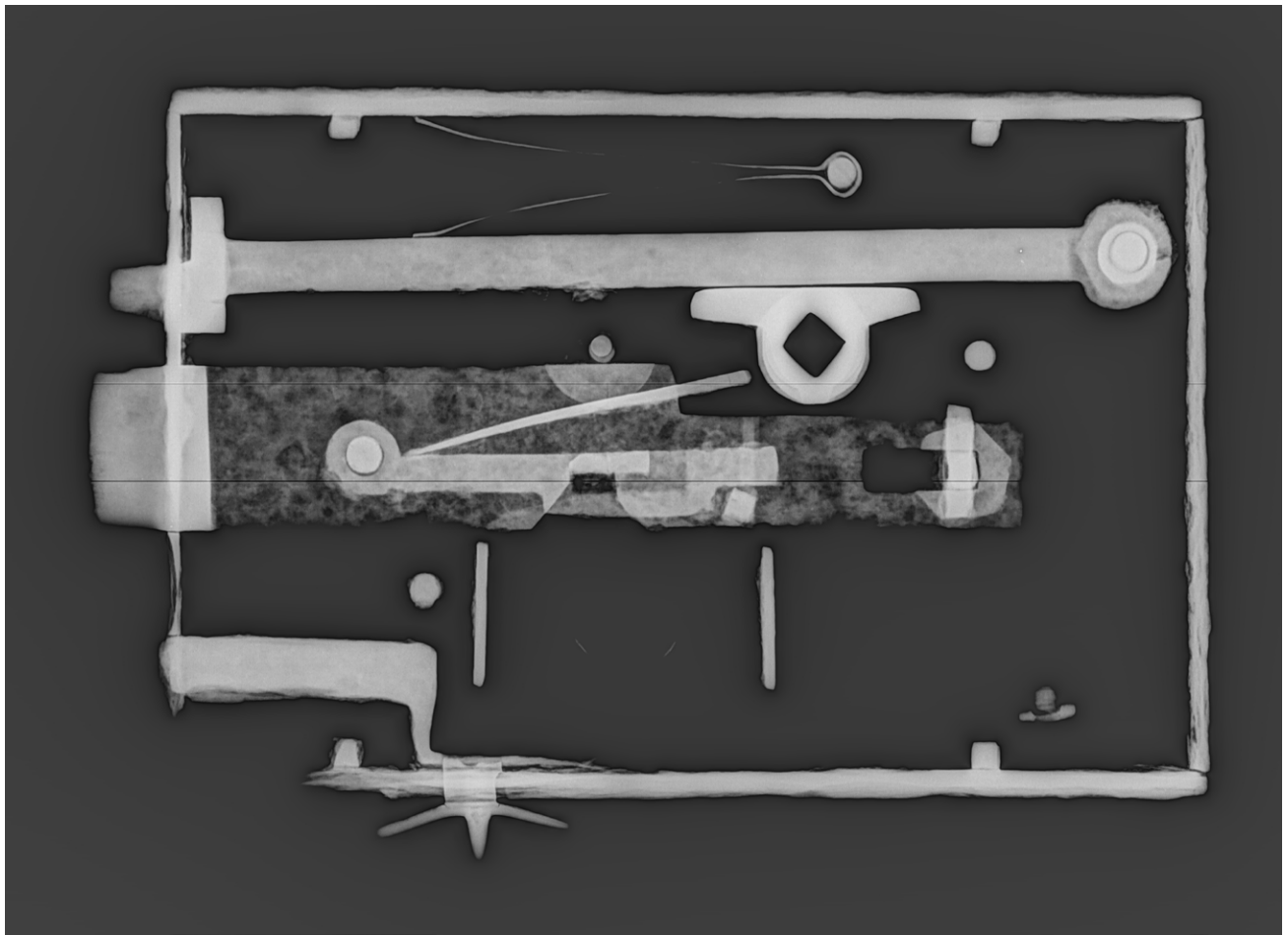


FIGURE 21. X-radiograph at the highest kv, showing likely loss of much of the bolt face and bottom of the lock that would result in displacement of the night bolt and probably the large rectangular bolt if corrosion were removed (479_SERC_lock_fl).

Treatment

Following X-ray fluorescence analysis confirming that the seal is made of brass, permission was granted by Hines for removal of the corrosion. The grayish-white material on top of the brass was removed mechanically using bamboo sticks, fine steel pins, and stainless-steel scalpel blades. Cleaning revealed the Carpenter inscription and royal arms of England (Figs. 22, 23), which can be compared to a drawing of the arms annotated to identify parts (Fig. 24). Details on the royal arm's shield include three superimposed lions representing England in the first and fourth quarters, while a rampant lion in a double tressure flory-counterflory represents Scotland in the second quarter, and a harp represents Ireland in the third quarter.

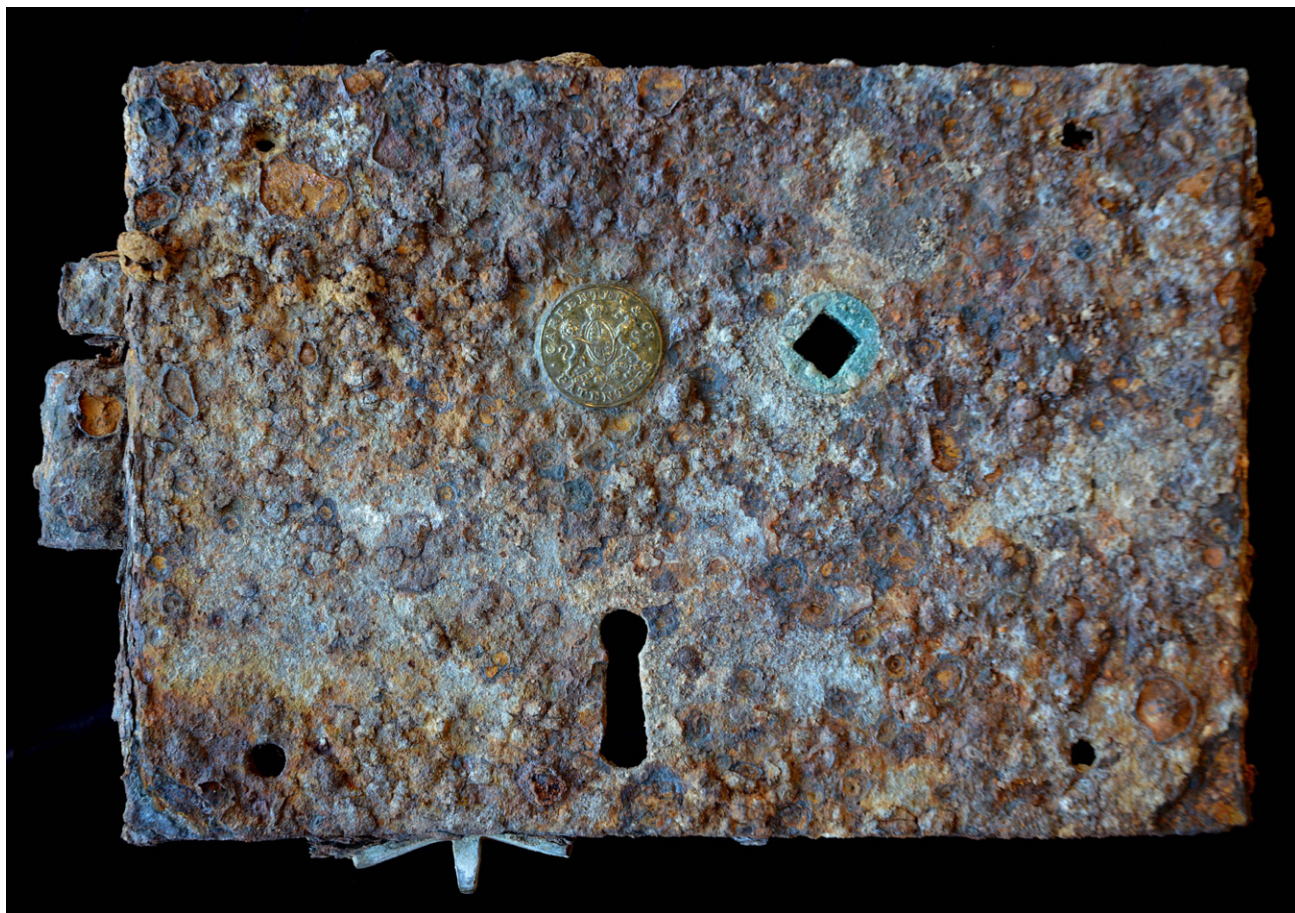


FIGURE 22. Face of the lock after treatment of the patent seal.



FIGURE 23. Detail of the patent seal taken in raking light.



FIGURE 24. Annotated royal arms of England explaining its parts (<https://www.britroyals.com/images/arms.jpg>, accessed November 21, 2020).

Recommendations for Further Treatment and Exhibition

Further treatment of the lock is not recommended, such as removal of the iron corrosion. The latter is not essential for the lock's preservation and would likely jeopardize its structural integrity.

It is recommended that the lock be exhibited in a climate controlled case with silica gel regularly conditioned in an oven to dry it out, because corrosion cannot occur in the absence of moisture. Ideally the exhibit case would be designed with a drawer or deck so that the silica gel can be easily checked and removed for reconditioning. Blue indicator gel can be incorporated in the colorless gel, turning pink with humidity as a sign that the gel needs to be reconditioned. It is likely that the gel will not require reconditioning during the winter, but it should be checked during warm weather when humidity is high.

Appendix A. X-Radiography Report on the Lock

Object: Box lock
Accession no.: 6955
Requester: Anson Hines, SERC Director
Telephone: 443.482.2208
E-mail: hinesa@si.edu
Unit: Smithsonian Environmental Research Center
Analyst: E. Keats Webb, MCI Imaging Specialist
Analysis date: October 1, 2020

Digital Radiography Technique:

Source: Philips MG 320 Tube
Distance from tube to object: ~ 51"
Scanner: GE Pegasus CR50P (Computed Radiography—CR)
Settings: 50 microns and low gain setting

Digital X-radiography was performed using was the Philips MG320 Constant Potential X-ray Unit (Fig. 25) and a computed radiography (CR) scanner, the Pegasus CR50P scanner (Fig. 26). Table 1 includes the exposure parameters. X-radiograph images were acquired using a 14 × 17" IPS phosphor plate from GE Inspection Technologies (Lewistown, PA, USA). Figure 27 illustrates the object positioned on the imaging plate cassette before exposure to radiation. The object was radiographed with the front face downward, so that the object lay flat on the imaging plate. The resulting radiographs were oriented to be in accordance with the images in the conservation report written up by Carol Grissom, MCI Senior Objects Conservator.

The plates were scanned using the GE Rhythm Acquire software at 50 µm and a low gain setting. The X-ray exposures were processed using the GE Rhythm Review software and the GE Rhythm Flash! filters. This processing optimizes each pixel with complex algorithms increasing the clarity of details and features. X-ray images were acquired using a 32-bit DICOM²³ file format, which allows for a wide dynamic range and the ability to process without degrading the image quality. The results were exported as TIFFs. The file naming provides information about the exported images: 'fl' indicates the Flash!filters have been applied and 'view' indicates that it is a screenshot of the viewport in RhythmReview, which includes the parameter information.²⁴

TABLE 1. Acquisition parameters

X-Ray#	kV	mA	Time (s)	Focal Spot
479	200	5	30	4mm
480	170	5	30	4mm
481	150	5	30	4mm
482	130	5	30	4mm



FIGURE 25. The Philips MG320 X-ray unit used for the digital radiography of the box lock.

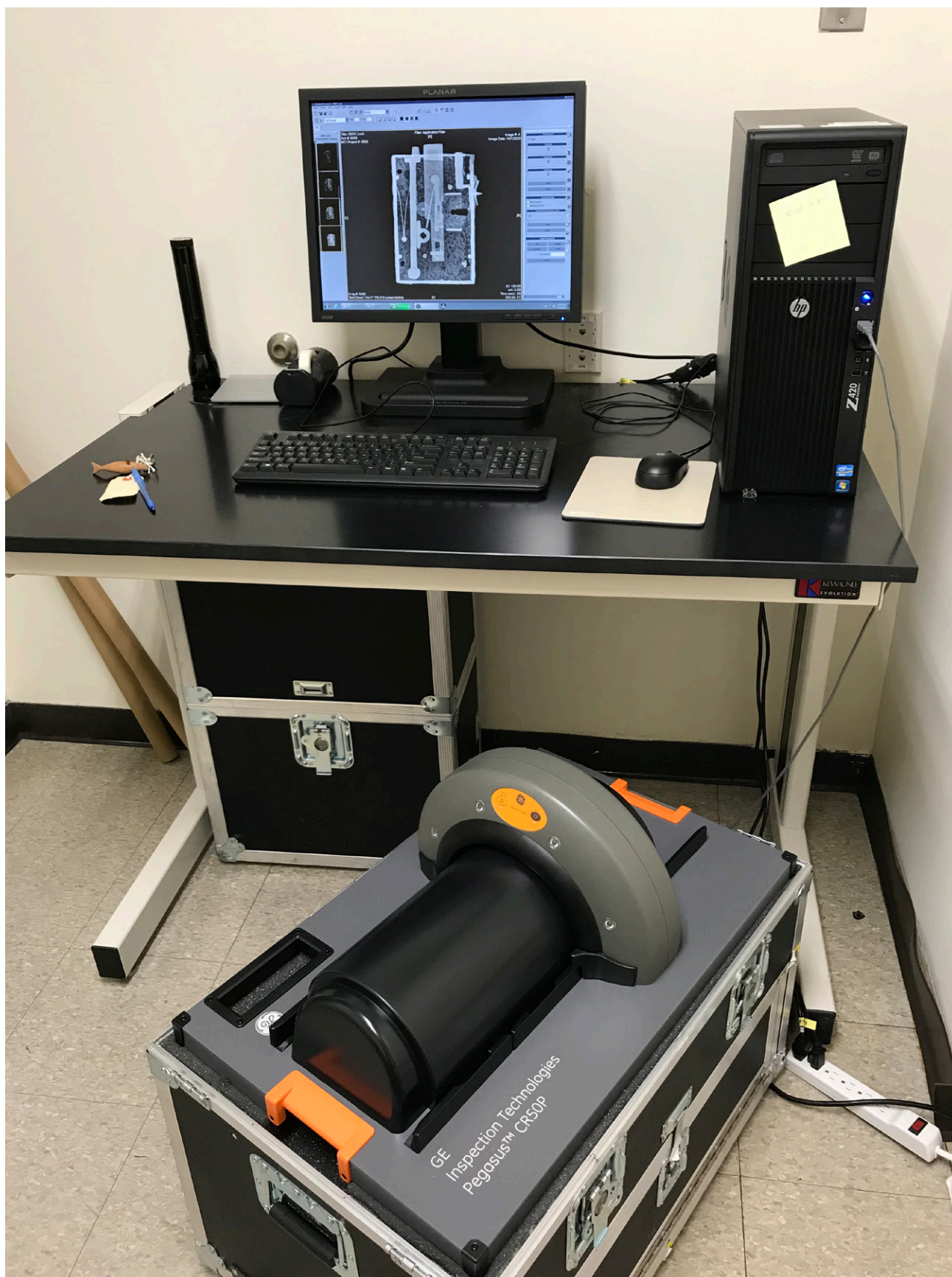


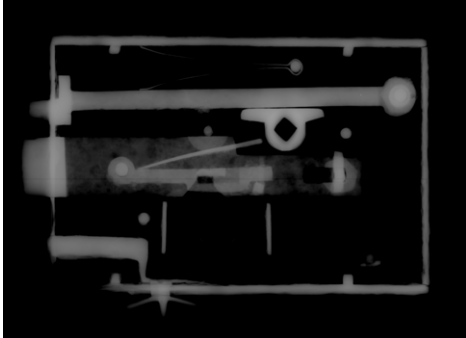
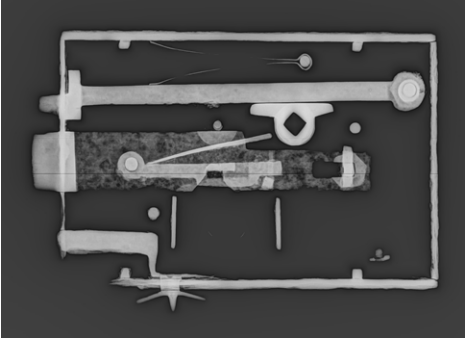
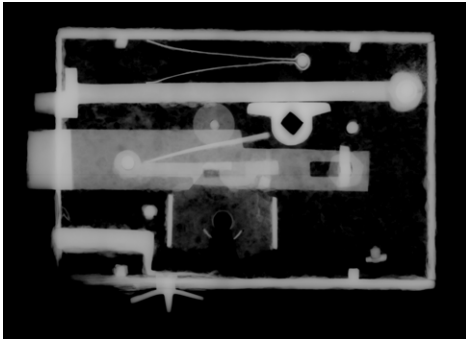
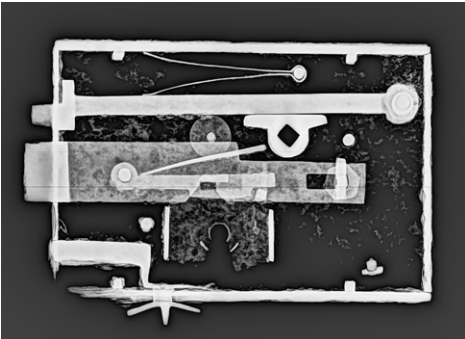
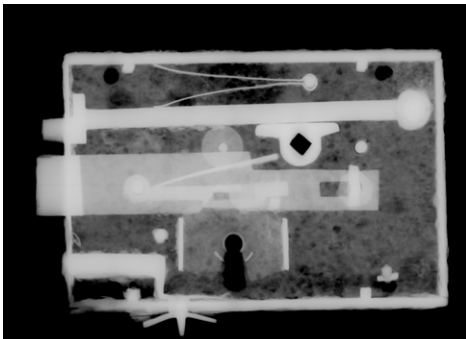
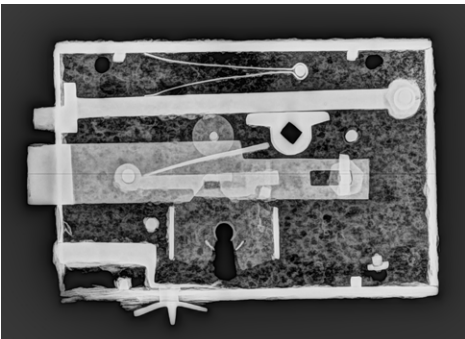
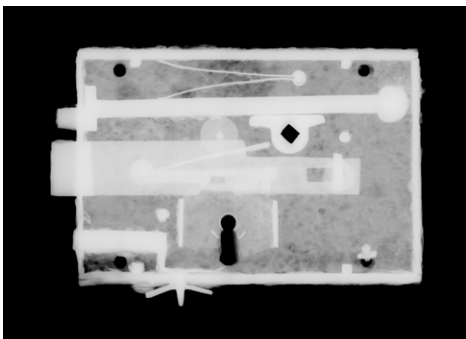
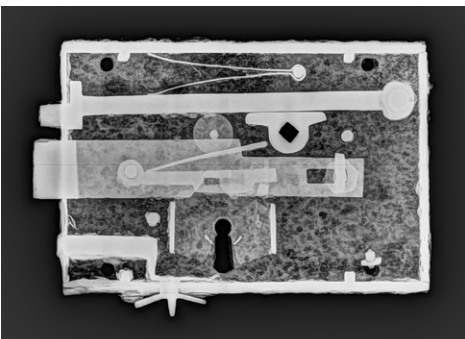
FIGURE 26. The Pegasus CR50P scanner and workstation used for scanning the imaging plates.



FIGURE 27. Box lock positioned on imaging plate cassette.

Imaging Results

The following results section includes the resulting images from the digital x-radiography of the box lock. The resulting images were provided to Carol Grissom for analysis and interpretation.

Exposure #	Without FLASH! Filter Processing	With FLASH! Filter Processing
479		
480		
481		
482		

Appendix B. Trump, "The Carpenter-Type Lock"²⁵

COLLECTORS' NOTES

The Carpenter-type lock

Most of us have observed, at one time or another, a type of iron rim lock with a manufacturer's small brass patent seal on its face. This kind of lock, in its most common form, is latched by an enclosed lever-type latch actuated by a pair of round brass knobs. The lock is secured by a drop-forged iron warded key, actuating the usual locking bolt. A brass-trimmed iron keeper is used, with a slot in the striking strip through which the lever latch may pass.

Because the dating of this type of lock often raises a question in the minds of architects and restoration experts, I should like to submit some of my findings on the history of the device.

The Carpenter-type lock, as it is called, was made in England beginning in 1830 and mostly for the export trade. It was widely used on many old buildings in this country and was advertised as late as 1865 by John Harper and Company, Ltd. of Willenhall, Staffordshire,

England. The inventor was a James Carpenter of Willenhall, who was born in 1775. Carpenter started in a very small business, manufacturing currycombs, towards the close of the eighteenth century. Soon after 1800 he built the Summerford Works at Willenhall. At first he probably manufactured the traditional iron rim lock, which is a box lock having a sliding spring bolt operated by round or oval brass knobs or brass drop handles. It was secured by a warded iron key operating a locking bolt, this also being a feature of the later Carpenter-type lock. The Carpenter type was at first considered an improvement on this earlier iron rim lock, and not until 1830 did James Carpenter patent his design. In cooperation with John Young, also of Willenhall, he placed British Patent No. 5880, January 18th, 1830, on this lock, the front view of which, bearing the patent seal reading *Carpenter and Co., Patentees*, is shown in Figure 1.

Figure 2 shows the works with the lever-type latch, the knob-operated cam, the key bolt, wards, and other minor parts. It will be noted that the works are of machined iron with the exception of the cam, which may be of cast brass or cast iron. The top and bottom of the lock, along with the vertical edge of the keeper and sometimes one end of the lock, as in this illustration, are of swedged or drop-forged iron in a modified U pattern, attached to the sheet-iron face by being riveted to square iron posts which in turn are riveted to the face. The end or ends are merely a continuance of the sheet-iron face bent at right angles.

When James Carpenter died in 1844 his business, at that time "Carpenter and Company," was transferred to his son-in-law, James Tildesley, who carried it on under the name of "Carpenter and Tildesley." This firm continued to manufacture the same type of lock, with the name *Carpenter and Tildesley* on the brass patent seal, until bought out by Messrs. Smithson late in the nineteenth century.

It is interesting to note that on the brass strips of the keepers of these Carpenter-type locks there sometimes appear, along with the manufacturer's name, the initials of the reigning monarch: G.R. (George IV, died in 1830); W.R. (William IV, reigned 1830-1837); and V.R. (Victoria Regina, reigned 1837-1901).

The Carpenter-type lock was made in large quantities by a number of firms during the second half of the nineteenth century. Typical are those made by John Walker of Birmingham, which bore an American eagle on the patent seal. Other contemporary locks of this type had either a sailing vessel, a bee hive, or the arms of England as the motif on the patent seal. No. 60 *Improved Lock* is all that appears on the patent seals of many examples, while *Smith, Badger*, or *Harper* is to be found on others.

In connection with my research I have collected more than thirty different varieties of the Carpenter-type lock and its accessories, all with different names, dates, and so forth. I have obtained a copy of the original patent of 1830 and have tapped many sources in England for information about the origin of this lock. W. H. Harper, Esq., President of John Harper and Company, Albion Works, Willenhall, England, and N. W. Tildesley, Esq., of Willenhall, both descendants of the original manufacturers, have given me most valuable assistance.

—ROBERT TOWNSEND TRUMP

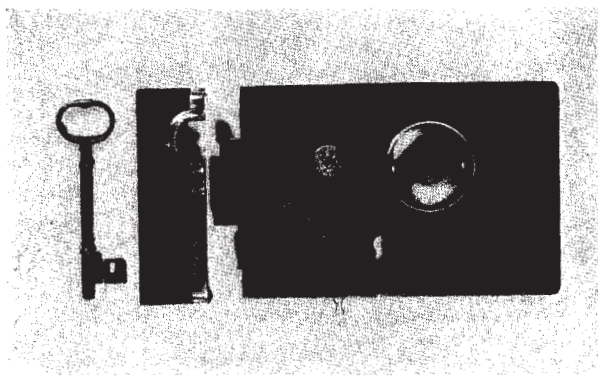


Fig. 1. Carpenter-type lock with patent seal of Carpenter and Company, patentees.

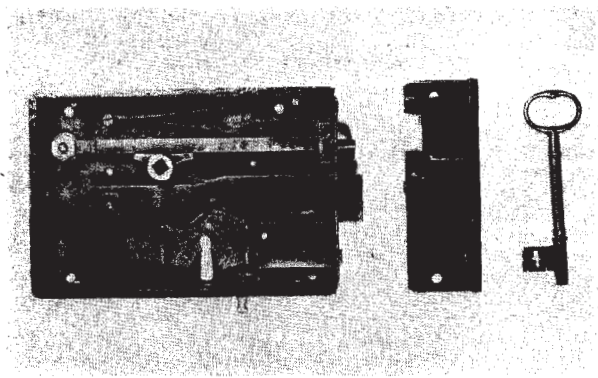


Fig. 2. Works of Carpenter-type lock, showing lever-type latch, knob-operated cam, key bolt, wards, etc.

Appendix C. X-Ray Fluorescence Report on the Lock

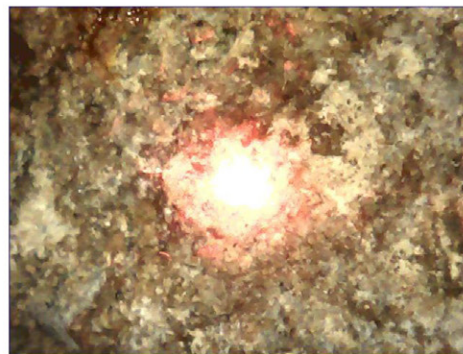
X-ray fluorescence analyses of the seal and tab on the lock performed by physical scientist Thomas Lam (MCI) using the Bruker Elio Portable Micro-XRF Spectrometer, October 21, 2020. *(Continued on next page.)*

white corr top left

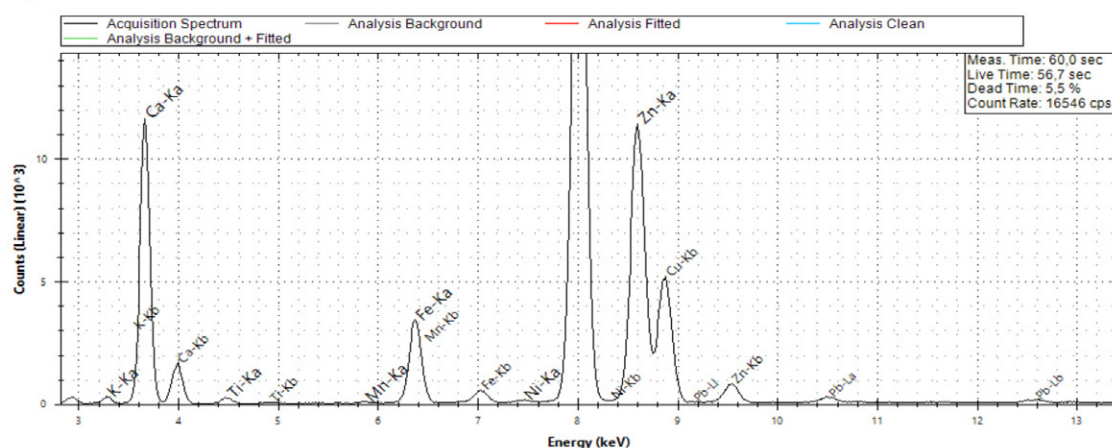
10/21/2020 3:23:55 PM



Measurement Time: 60,0 s
Tube Voltage: 50 kV
Tube Current: 40 μ A
Tube Target Material: Rh
Elio Device: SN1256
Device Mode: HeadMotor
Acquisition Mode: Manual
Acquisition Channels: 4096
Sample to Detector Material: Air



Spectrum:



Analysis Results:

Element	Concentration	Error
Ca	51,66%	$\pm 0,29\%$
Cu	30,31%	$\pm 0,16\%$
Zn	10,59%	$\pm 0,24\%$
Fe	4,04%	$\pm 0,48\%$
K	1,71%	$\pm 1,84\%$
Ti	0,97%	$\pm 1,91\%$
Pb	0,54%	$\pm 1,68\%$
Ni	0,1%	$\pm 2,58\%$
Mn	0,07%	$\pm 4,03\%$

Analysis Date and Time: 10/21/2020 3:58:17 PM
Analysis Type: Advanced
Spectrum Left Cut: 1 keV
Spectrum Right Cut: 50 keV
Spectrum Upper Limit: 50 keV
Use M Line: False
Super Impose Peak Areas: False

Selected Elements for Analysis:
Pb, Zn, Cu, Ni, Fe, Mn, Ti, Ca, K

Included Elements for Fitting Analysis:
Pb, Zn, Cu, Ni, Fe, Mn, Ti, Ca, K

Notes:

Project File: SERC LOCK

1

tab of lock

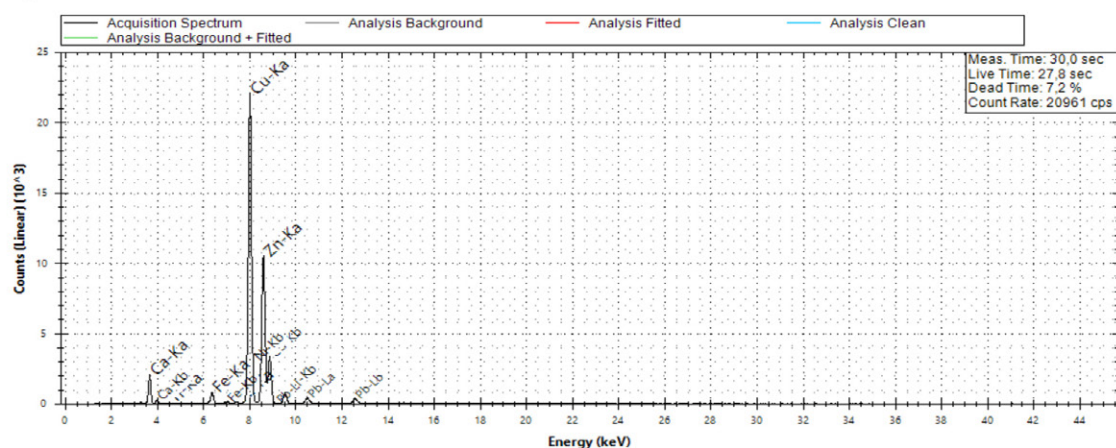
10/21/2020 3:51:41 PM



Measurement Time: 30,0 s
Tube Voltage: 50 kV
Tube Current: 20 μ A
Tube Target Material: Rh
Elio Device: SN1256
Device Mode: HeadMotor
Acquisition Mode: Manual
Acquisition Channels: 4096
Sample to Detector Material: Air



Spectrum:



Analysis Results:

Element	Concentration	Error
Cu	49,48%	$\pm 0,18\%$
Ca	24,03%	$\pm 0,68\%$
Zn	21,03%	$\pm 0,25\%$
Pb	3,38%	$\pm 1,15\%$
Fe	1,55%	$\pm 0,99\%$
Ti	0,36%	$\pm 4,09\%$
Ni	0,17%	$\pm 2,28\%$

Analysis Date and Time: 10/21/2020 3:56:55 PM
Analysis Type: Advanced
Spectrum Left Cut: 1 keV
Spectrum Right Cut: 50 keV
Spectrum Upper Limit: 50 keV
Use M Line: False
Super Impose Peak Areas: False

Selected Elements for Analysis:
Pb, Zn, Cu, Ni, Fe, Ti, Ca

Included Elements for Fitting Analysis:
Pb, Zn, Cu, Ni, Fe, Ti, Ca

Notes:

Project File: SERC LOCK

1

Notes

1. Results of subsequent XRF and SEM EDS analyses performed by Lam in 2021 on a silver-plated brass knob from the rear door Carpenter lock and a silver-plated brass escutcheon plate/draft cover from an adjacent salon door in 2021 are reported in MCI 6955.2.
2. Robert Townshend Trump, "The Carpenter-Type Lock," *Antiques* 66, no. 6 (December 1954), 482 (reproduced in Appendix B). Donald L. Fennimore, *Metalwork in Early America* (Winterthur, DE: Winterthur Museum, 1996), 391–392 (reproduced as Figures 14, 15).
3. Trump, "The Carpenter-Type Lock."
4. Analyses by Lam of a silver-plated brass knob from the Carpenter lock on the rear door of the house found that the brass consists of two parts copper to one part zinc with few trace elements. See MCI 6995.2.
5. Trump, "The Carpenter-Type Lock."
6. See, for example, "Early 1800s Carpenter 60 Rim Lock," YouTube video <https://www.youtube.com/watch?v=uKjq7X2uaPk> (accessed October 6, 2020).
7. Trump, "The Carpenter-Type Lock."
8. James Tildesley was James Carpenter's son-in-law who carried on the business after Carpenter's death in 1844. Trump, "The Carpenter-Type Lock."
9. Full Circle Architectural Antiques, <https://www.fullcirclearchitecturalantiques.com.au> (accessed October 9, 2020).
10. An example of the same seal on a Carpenter lock appears in Dean L. Anderson, "A Carpenter Lock from Minnesota's Historic Fort Snelling," *APT Bulletin* 9 (1977) 67–72.
11. Russell & Erwin Manufacturing Company, *Illustrated Catalogue of American Hardware of the Russell and Erwin Manufacturing Company: An Unabridged Reprint of the 1865 Edition and a New Introduction by Lee H. Nelson* (Association for Preservation Technology, 1980 [1865]), 5.
12. Fennimore, *Metalwork*, 453, n32.
13. Donald L. Fennimore, former curator of metalwork at Winterthur Museum, noted that similar slides are found on locks made in many different places. Personal communication, October 6, 2020.
14. Lee H. Nelson, "Introduction," in *Illustrated Catalogue of American Hardware of the Russell and Erwin Manufacturing Company*, vi–vii. Trump, "The Carpenter-Type Lock."
15. Building Conservation Associates (BCA), "The Sellman/Kirkpatrick-Howat House (Woodlawn), Historic Structure Report, April 2017, vol. 1, 217, 242, 247.
16. BCA, "The Sellman," 242. Height measurements and the signature of Jonathan Sellman (1890–c. 1980) in the small bedroom indicate that he occupied it as a boy, suggesting that it may also have been the room of Alfred's son Richard Sellman (1846–1902) when he was a boy.
17. BCA, "The Sellman," 242, 3.182, 3.183, 3.184.
18. XRF and SEM EDS analyses by Thomas Lam and silver foil seams observed by Grissom identified the materials and technique of close plating. MCI 6995.2
19. Plantation proceeds declined after the death of Alfred Sellman in 1854 and the eventual take over by Richard Sellman. BCA, "The Sellman," 63.
20. Fennimore, personal communication, 24 May 2021.
21. BCA, "The Sellman," 242, 247, 3.186, 3.187, 3.188.
22. BCA, "The Sellman," 3.87.
23. DICOM = Digital Imaging Communications in Medicine.
24. Screenshots from the viewport do not have the same orientation as the processed radiographs. Webb was unaware of the appropriate orientation when initially processing the radiographs. In the text, x-radiographs reflect the position of the lock in situ on the left face of a door.
25. Trump, "The Carpenter-Type Lock," 482.