Newsletter of the Horological Tool Chapter #173 of the NAWCC

Tool Enthusiasts' Round-Up

In This Issue: Nathaniel Mulliken and His Clockmaking Tools

A Barrel Grooving Tool Used By the Mulliken Family

Winter 2014

No. 22

The Horological Tool Chapter of NAWCC

The Tool Enthusiasts' Round-Up is the newsletter of the Horological Tool Chapter #173 of the National Association of Watch and Clock Collectors Inc., a non-profit educational organization. This chapter and its newsletter are intended to foster interaction among NAWCC members who share a common interest in the use and collection of horological tools of all sorts. If you have an item you have researched, a book of interest, or notes on a project you have made, please consider sharing your knowledge with others through the newsletter.

The annual chapter dues of $10 will ensure that members receive the newsletter and are included in the Membership Directory when it is published. Members are also entitled to one classified ad in each issue.

Board of Directors

President: Ron Bechler
726 Royal Glen Drive, San Jose, CA 95133
(408) 926-3212, Email: ronbechler@comcast.net

Vice President: John Koepke
2923 16th Street
San Pablo, Ca 94806
510-236-2197, email: jskoepke@comcast.net

Secretary/Treasurer: Dave Kern
5 Hilltop Drive, Manhasset, NY 11030
(516) 627-1012, Email: dkern@optonline.net

Editorial Director: Bruce Forman
234 Eagle Ridge Drive, Valparaiso, IN 46385
(219) 763-4748, email: forman21@netzero.net

Editorial Team:
Deena Mack
Tom Hammond

Award Winner

NAWCC Chapter 173 member, Susan Wood, won national recognition for her Tulip Clock that was entered in the 2014 Craft Competition at the NAWCC National Convention. The Tulip Clock exhibits her exceptional skills as a blacksmith and a clockmaker.

Susan has forwarded the Editor a most interesting set of photographs showing how she made this clock and we hope to share these in a future issue of the Tool Enthusiasts' Round-Up.

Two other members of Chapter 173 also won awards at the craft competition and we hope to share their stories with you also.

Bruce Forman

Nathaniel Mulliken and His Clockmaking Tools

By

Richard Newman and Bruce Forman

Few clockmaking tools exist from the 18th century. These tools somehow escaped their own obsolesce and the scrap metal drives of World War I and World War II. Normally, antique tools come without instructions and it is up to the tool collector to determine just how they were originally used. Rarer than the discovery of a single 18th century clockmaking tool, is the discovery of a set of clockmaking tools and the parts that they made. When such a find occurs, it gives tool scholars a chance to better understand the traditional clockmaking process and to re-examine their own theories as to how early clocks were made. This article shares the story of how the Nathaniel Mulliken clockmaking tools and clock parts survived and what they can tell us about early American clockmaking techniques.

In 2011, Richard Newman spent time with Dick Ziebel, one of the NAWCC's most knowledgeable old timers. It was at that time, Richard first learned of Nathaniel Mulliken's clockmaking tools and parts. This collection passed from one generation of the Mulliken family to the next, tucked away among the rafters in a shed, located in Newburyport, Massachusetts. It was not until an estate auction in 1978, that they left the family and were later purchased by Dick, who has cared for them ever since. Although oral tradition stated that the tools and parts originated with clockmaker Nathaniel Mulliken (1722-1767), no written documentation accompanied the collection. It was not until Richard expressed an interest in their history, that he and Dick started piecing together the provenance and the significance of these artifacts that were used to produce some of the finest early American clocks ever made.

Although there are numerous references to the Mulliken family and their horological activities in books and articles, there has never been a comprehensive account of the family published to our knowledge. One possible explanation for this, is the difficulty in understanding the family genealogy because of the repeated use of the same given names for offspring. A complete history of the Mulliken family tree of clockmakers will appear in a future article to be published in the NAWCC Bulletin but, we include a short synopsis here.

John Mulliken (1690-1737) was a blacksmith and the father of Nathaniel (1722-1767) and Samuel (1720-1756). He apprenticed both of his sons to an uncle, Jonathan Mulliken (born ca. 1701), who lived in Bradford, Massachusetts, and is likely one of the earliest clockmakers to have worked in Colonial America. Shown in Figure 1, is an early 30-hour posted frame (also called birdcage) tall case clock movement and dial signed, Samuel Mulliken, Bradford. It is believed to have been made circa 1740 and illustrates the type of clockwork that the family made at that time.

Nathaniel (1722-1767) relocated to Lexington, Massachusetts, in 1751, upon falling in love with Lydia Stone. His brother Samuel (1720-1756), initially stayed in Bradford but later moved to Newburyport, Massachusetts, where he died a few years later in 1756. Samuel's son Jonathan (1746-1782), who was only 10 years old at the time of his father's death, he later apprenticed with Nathaniel (1722-1767) in Lexington. Jonathan learned the clockmaking craft and became a master clock and watch maker in his own right settling in Newburyport. Samuel's (1720-1756) probate records survive and the inventory of his tools and supplies include references to clock engines. (Reference 1)

Figure 1. Samuel Mulliken, Bradford, Massachusetts, posted frame movement, circa 1740
(Courtesy Skinner Inc., Boston, www.SkinnerInc.com)

Figure 2. Nathaniel Mulliken, Lexington, Massachusetts 8-day
plated movement with date and seconds, circa 1765
(Courtesy Old Sturbridge Village)

Figure 2, shows a picture of a fine 8-day tall clock that Nathaniel (1722-1767) made in Lexington, about 14 years after leaving Bradford. Nathaniel had a son also named Nathaniel (1752-1776) who was only 15 years of age when his father died. Because Nathaniel had not yet completed his apprenticeship, journeyman, clockmaker, Benjamin Willard (1743-1803) took over the Lexington clock shop and ran it until Nathaniel reached maturity.

Lexington was a hot bed of revolt just prior to the American Revolutionary War. It was here that British troops fought the famous Minutemen before being turned back at Concord. During their retreat, Lexington was looted for supplies and burned. One property that caught fire that day was the home and clockshop of Nathaniel Mulliken (1752-1776).

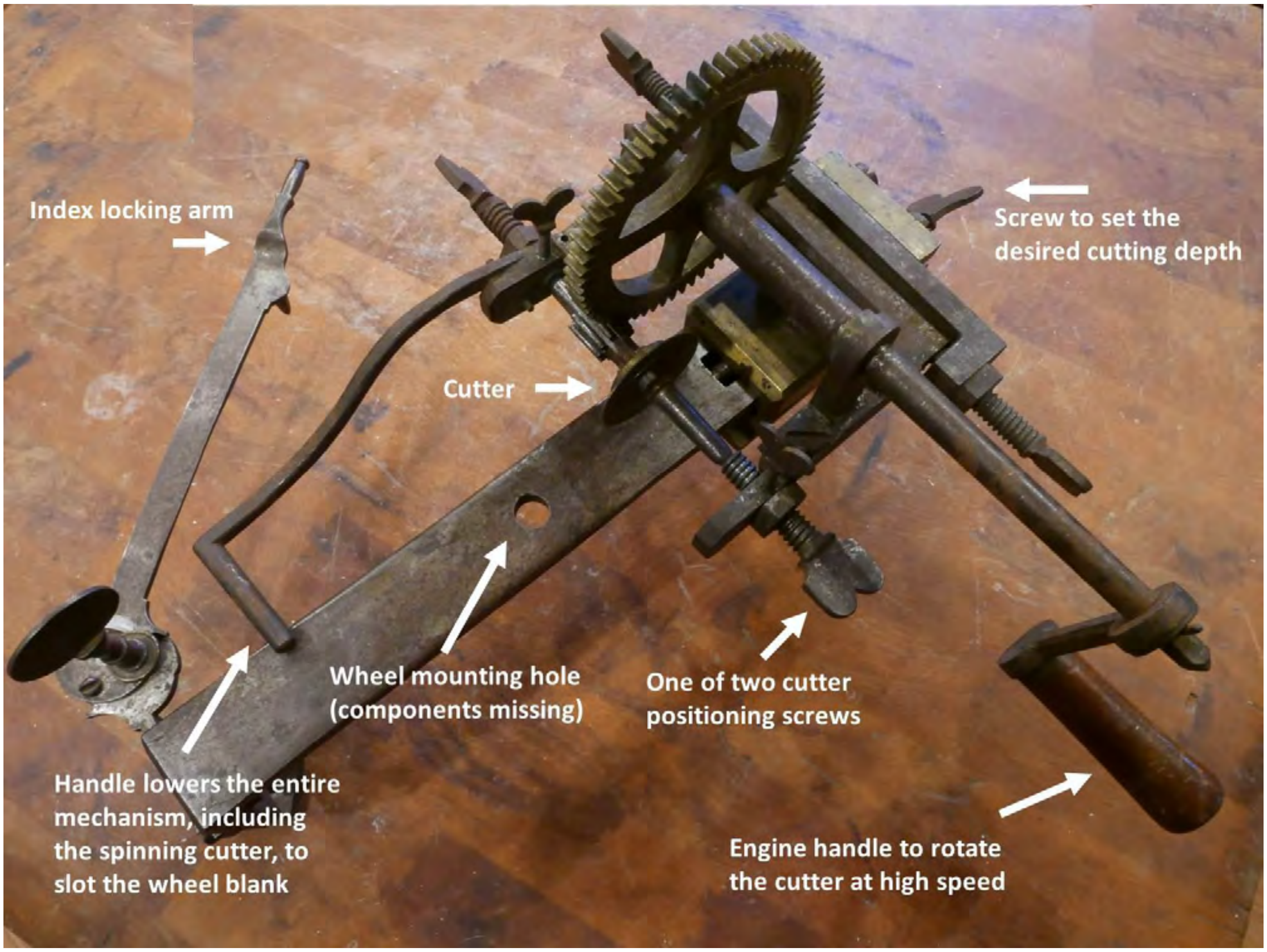

Figure 3. This wheel cutting engine was used to cut a proportional number of slots into varying sized wheels before shaping the teeth with a file.

He managed to save a number of clocks and his essential clock making tools before the shop burned to the ground along with the family home. (Reference 2) The date was April 19, 1775, and Nathaniel Mulliken (1752-1776) was just 23 years old. According to historical accounts, his younger brother John (born 1754), a fine cabinet and case maker, was one of the hundreds of Minutemen in pursuit of the British after the Battle of Concord. He collapsed in tears when he came through Lexington and witnessed the destruction of the family home. (Reference 3)

Assuming the attribution of the tools to Nathaniel Mulliken (1722-1767) is correct, they were likely used by many of the aforementioned clockmakers, including his oldest son (Nathaniel) and Benjamin Willard. As already discussed, his oldest son Nathaniel (1752-1776) appears to be the last of the Mullikan's to have made clocks in Lexington and we surmise that after his death in 1776, the tools passed to his Newburyport relatives who continued making clocks well into the 19th century. While impossible to determine the succession of the tools with certainty, the collection's more recent history has been successfully traced and verified.

The most important and oldest tools in the collection are the iron and brass wheel cutting engine (Figure 3), and a seldom seen barrel grooving engine that was used to cut a spiral on the barrel to prevent the weight cords from fouling when winding-up (Figure 4). Both were likely made by a local Massachusetts blacksmith in the mid-18th century, although it is also possible that clockmaker Nathaniel (1722-1767) or Samuel (1720-1756) made them. Early clockmakers often had significant blacksmithing skills and no doubt both brothers received training from their father, a blacksmith, before he passed away in 1737; Nathaniel is known to have had a blacksmith shop in Lexington, likely part of his clock making shop, where fine andirons and other items were forged.

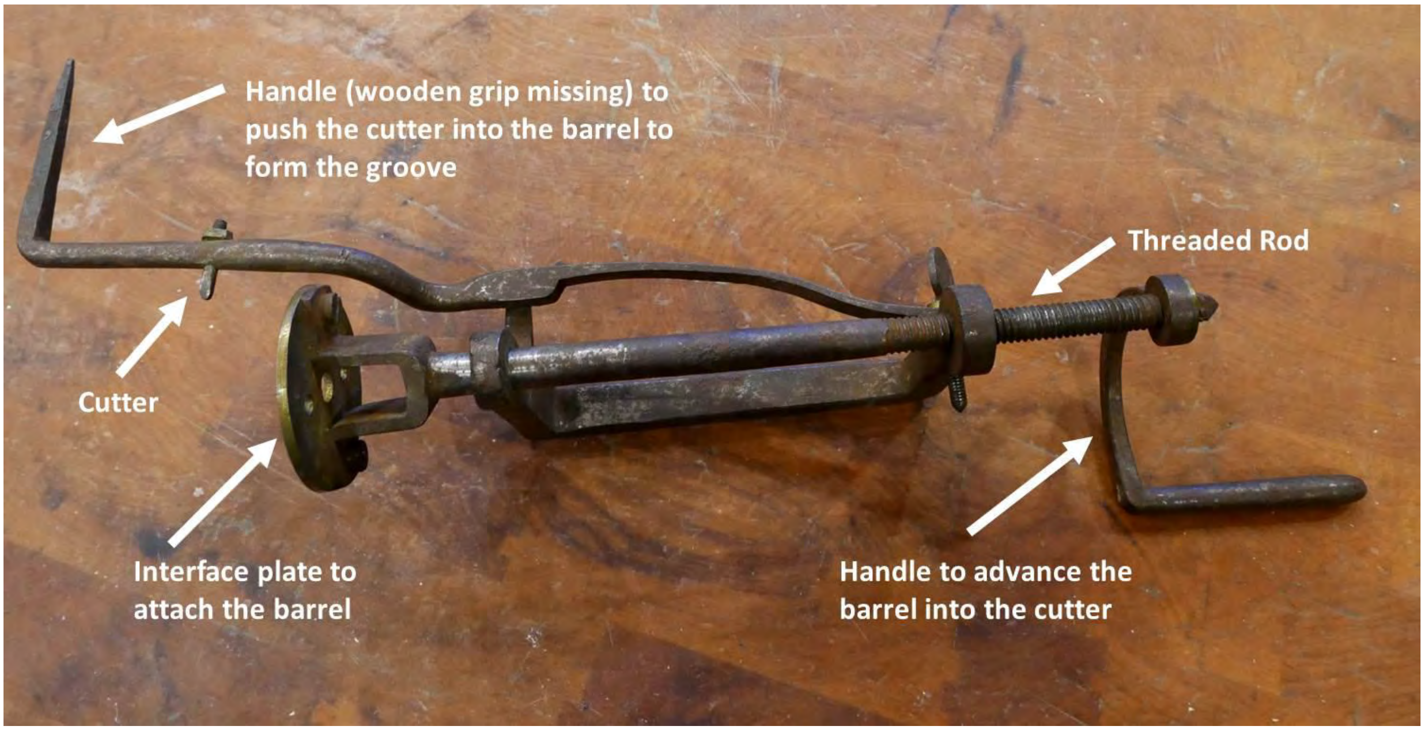

Figure 4. This simple single purpose barrel grooving engine was held in a bench vise and used to cut a spiral thread into the time and strike winding barrels.

The third and last tool in the collection is a well-worn bow drill used to drill pivot and pillar holes in clock plates. The bow is now missing from the Mulliken drill set but numerous ferrules and some drills have survived, Figure 5 (left). The use of a bow drill is illustrated by clockmaker, John Shallcross, who uses a "breast plate" to steady and press the drill against the clock plate (or other component) during the drilling process, Figure 5 (right). In comparison, the Mulliken's replaced the "breast plate" in their drill set with a "drill hand" that served the same purpose. This example could have been hung around the clockmakers neck with a piece of cord or hand held in virtually any position, Figure 5 (left).

Figure 5. The Mulliken bow drill set (left) and a hole being drilled with a bow drill (right).

Figure 6. Templates for different clock parts.

The collection also has templates for making clock parts including a pallet and lift lever (Figure 6), and patterns for casting wheels. A large number of brass wheels and steel pinions in different stages of manufacture are included. Later, members of the Mulliken family are known to have made shelf clocks and sets of cast finials and feet apparently for Massachusetts-style shelf clocks are present. In addition, taps, watch bows and other miscellaneous items are contained in the Mulliken collection together totaling over 50 pieces.

Figure 7. Brass wheel castings and patterns in the Mulliken collection.

Of particular interest is the large amount of foundry related items that suggest the Milliken's were casting their own clock parts or subcontracting this work to a local brass foundry. The brass wheels in the collection are also important because they are unfinished and therefore give new insight into the wheel making process in Colonial America, Figure 7. For example, what appears to be a brass wheel blank is actually a metal pattern used for sand casting, Figure 8 (left). We can tell this is a pattern, because a 3 degree taper has been filed on its edges. This taper is known as draft in the foundry industry; aids in the removal of the pattern from the sand mold. Once removed, the resulting cavity is filled with molten brass that then solidifies into the raw clock casting.

If a clockmaker had only one wheel pattern, he could only make one sand mold at a time. Hence, the production of clock parts was a very slow process that would require multiple molds to make enough clock parts to build a single clock. However, if multiple patterns were available, they could be packed in the same sand mold and connected by passages to allow for casting several parts at one time. Because of the primitive foundry methods in Colonial America, it was not uncommon to produce defective castings when trapped air or bits of sand came free from the mold wall. Casting multiple parts increased the probability that a clockmaker would get at least one good casting to finish from a single pour of metal.

Figure 8. Close-up of sand casting patterns made of brass (left) and lead (right).

A typical 8-day tall case clock movement can have over eight different size wheels. Making that number of different sand casting patterns was a time consuming process, and the task was multiplied many times over if the clockmaker wished to make multiple patterns of the same wheel. A clue as to how this time consuming process could have be done more efficiently in Colonial America comes from the unusual lead wheel casting found in the Mulliken collection, Figure 8 (right).

The casting is defective and it appears that someone scribed layout lines on the blank in preparation to remove the excess metal. This job was never finished, but the more intriguing question is why would anyone cast a lead gear? We believe that the answer to this question comes from a second collection of early American clockmaking tools. This collection is owned by the Henry Francis DuPont Winterthur Museum and came from the Dominy family of clockmakers who worked in East Hampton, New York, beginning in the late 18th Century. Like the Mulliken collection, brass patterns to make wheels are present. The Dominy collection also has a wooden block with a cavity that is the same size and shape as the wheel blank. A sprue is cut into the wood and the blackened surface indicates that it was used as a mold. Given that brass melts at over 1800°F, it is unlikely that the (tulip wood) mold was used to cast brass because it has suffered little damage.

However, lead melts at a much lower temperature than brass, about 400°F, and this may have been the metal used for casting. Therefore, one explanation for the wooden mold is that it was part of a rapid prototyping system used to make clock wheel patterns from lead. The authors put this hypothesis to the test by turning a wooden mold on a lathe, hollowing out the rim and center to the desired wheel dimensions, and cutting out the wheel spokes using a wood chisel. The wooden mold was heated to 250°F to drive off any moisture, and after the drying process was complete, a candle flame was used to coat the wood surface with carbon to protect it from the casting process and aid removal of the casted wheel.

When used for casting lead, the experimental wooden mold was successful and the lead castings retained good detail, as shown in Figure 9. The samples produced in the experiment could easily be finished and used as patterns to produce brass wheels using the sand casting process. This rapid prototyping process using a wooden mold and lead took just over one hour to complete and therefore is significantly faster than making multiple brass or wooden patterns. Given that lead is softer than brass, they may have had a shorter life, but on the other hand more could easily be cast again using a wooden mold like the one represented in the Dominy collection.

Figure 9. Casting lead wheels with a wooden mold.

Figure 10, Examples of defective castings used for wheel cutting in the Mulliken collection.

Most of the wheel castings found in the Mulliken collection are good examples of rejects likely destined to be remelted as scrap. Many of the wheel spokes were not properly formed which occurs when the pattern is removed from the sand mold and some of the molding sand sticks to the pattern. Subsequently the cavity is filled with molten brass and produces the defect shown in the illustration, Figure 10. Although the casting was defective, the wheels could still be used for making test cuts using the wheel cutting engine or as a backing plate when cutting a first quality wheel blank in the engine. When a backing plate is used during cutting, the metal bur normally left on the cut wheel is eliminated but will appear on the backing plate as the cutter exits the stack. This results in less work for the clockmaker who would normally have had to debur the finished clock wheel.

Figure 11. Mulliken wheels after being slotted with the flash still present.

A more perfect wheel casting in the collection is shown in Figure 11. Notice that although the wheel faces are finished by filing flat and turning on a lathe, there is still flash on the spokes. This gives evidence that the spokes were finished last only after the clockmaker was sure that the wheel was correctly cut. Perhaps these wheels were rejected because the teeth are too thin for the desired pitch. It is also interesting to point out that the wheel teeth are just slots without a tooth profile. The slitting saw or rotary file, as found installed in the Mulliken wheel cutting engine (Figure 3 & 12), made these slots. This type of cutter is much easier to make than a wheel cutter with a profile. Although profile cutters were known during the 18th century, they do not appear to have been commonly used. This is probably because there was a lack of precision in the total manufacturing process. At any rate, the wheels in the collection evidence that the tooth profiles were slotted first and then filed by hand, as shown in Figure 13. This rounding-up process was time consuming but not difficult for an experienced clockmaker.

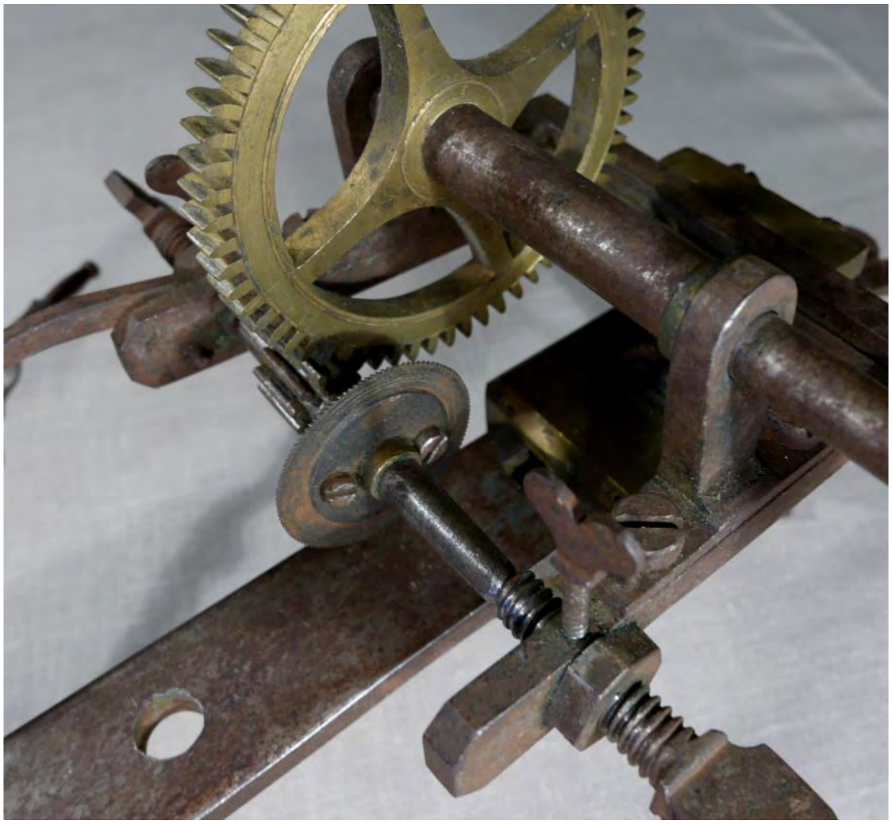

Figure 12. The slitting saw used to cut the teeth.

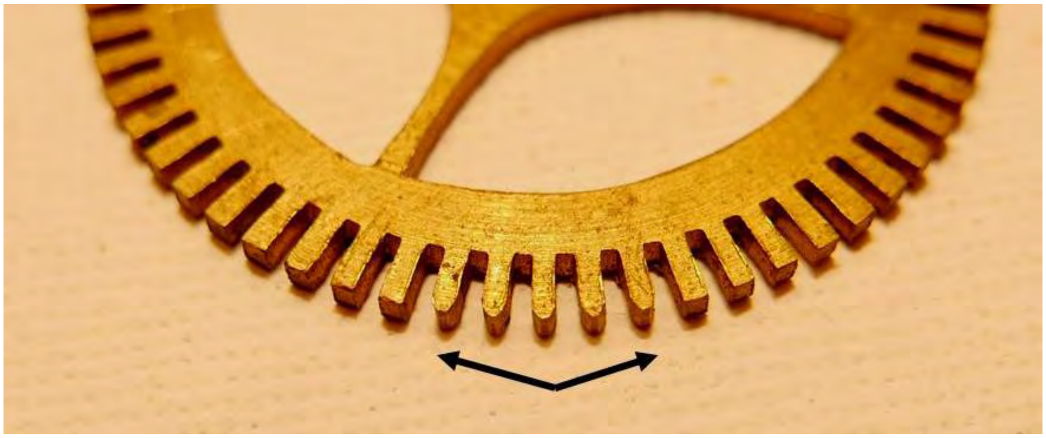

Figure 13. The clockmaker has begun to file or round-up the profile on the slotted gear teeth.

So we now have a good picture of how clock wheels were made in 18th century Colonial America. They were first sand cast using a wheel pattern that was rammed into casting-sand, removed, and filled with melted brass. The wheel faces were filed flat, center hole drilled, and outside rim trued on a lathe before slotting with the wheel cutting engine. The casting flash was removed and the crosses and inside rim filed. The clockmaker then filed the teeth profiles in small batches, testing the depth and meshing as he went. Lastly, the wheels were filed and polished to the desired quality finish.

Figure 14. Unfinished pinions found in the Mulliken collection.

Each clock wheel in the gear train needed a mating pinion that was made from a small steel forging. After drawing out the forging to length, the ends were tapered and the shaft roughly turned on a lathe, Figure 14. The pinion blanks were then slotted and the gear profile was added by hand filing, Figure 15. Pinion blanks are known to have been made in America; however, American clockmakers also purchased them from England. Lancashire was a major producer of horological parts and advertisements for these imported pinions can be found in local American newspapers of the time (Reference 4). With the availability of cheap pinions in standard sizes, there was probably little incentive for most American clockmakers to make their own pinion blanks.

Figure 15. Slotted pinion (left) and after rounding-up (right).

Figure 16. A Lancashire pinion cutting engine.
(Private Collection)

Figure 16, shows a Lancashire pinion cutting engine that was used to slot pinion teeth. The pinion was supported between two dead centers during cutting. The pinion was indexed using a latch plate that was pressed onto the pinion shaft before cutting began and was removed after cutting was completed. Some of the pinions in the Mulliken collection are identical to known Lancaster made pinions. However, there is evidence that the Mulliken family may have made their own at one time. There are several indexing latch plates in the collection that might be mistaken as strike count wheels at first look. In fact, they are slotted and marked with divisions associated with pinions, Figure 17. In one example, two sets of slots, each corresponding to a separate pinion count, are cut into one plate. No pinion cutting machine is extant in the collection but one explanation could be that these plates were associated with the building of shelf clock movements for which no standard pinion was readily available and the engine, if built, was inferior and later discarded.

Figure 17. Latch plates believed to relate to pinion cutting.

This brings us to the end of our story of how the Mulliken clock tools and parts survived for the last 200 years. They are truly a time capsule of information that allows us to appreciate how difficult and time consuming it must have been to build a tall case clock in the 18th century.

References

1) Commonwealth of Massachusetts, Southern Essex District Registry of Deeds, Shetland Park, 45 Congress Street, Salem Massachusetts

2) Robert E. Tomasson, *The Best of Americana in Hartford*, The New York Times, October 2, 1983; Tomasson reports that a tall clock pulled from the burning clock shop by Nathaniel Mulliken will be on display at the 17th annual Connecticut Antiques Show in Hartford. Author's note: there is no surviving evidence that the tools were present in the Mulliken's Lexington clock shop when the British attacked in 1775; however, given time to save clocks before the shop burned to the ground, it is certainly reasonable to presume that Nathaniel also saved the irreplaceable clock making tools that he inherited from his beloved father and were so essential to his livelihood.

3) *Proceedings of the Lexington Historical Society, Vol. III.*, Lexington Historical Society, Lexington, Massachusetts, 1905, p. 135

4) J. Carter Harris, *The Clock and Watch Makers American Advertiser*, Sussex, UK, Antiquarian Horological Society, 2003.

Classified Advertisements

Wanted

Levin and Derbyshire headstock and tailstocks (lever feed) in 10 mm sizes, any condition, running or not. Also 10 mm Levin collets and other related equipment. M. L. Shetler, Watchmaker, 7676 Route 62, South Dayton, N. Y. 14138

Deckel, Aciera, Rivett, Schaublin, Lorch, Hardinge, Levin, lathe or mill accessories wanted. Will trade, or sell if I have duplicates. Mark Fulmer
(330) 877-2021, Markusfu@hotmail.com

Derbyshire Elect model lathe attachments- pivot polisher, screw cutting attachment, roller file rest, and screw feed tailstock - will trade - for sale: tools from the Elgin watch factory, lathes, grinders, millers, etc…some made by American Watch Tool. J. Dill, 2117 22nd St. Road, Greeley, Co. 80631, Tel: 970-353-8561, jimdle@yahoo.com.

Schaublin 102 Lathe milling attachment, Bruce Forman, 234 Eagle Ridge Drive, Valparaiso, IN 46385, (219) 763-4748, email: forman21@netzero.net will buy or trade.

For Sale

Now available on CD is a partial reprint of the A. C. Becken Company Catalogue. This catalogue is undated but is believed to have been printed in the early part of the 1900s. There is a lot of detailed information on watch and clockmaking tools. Please send a check for $13 to Chapter #173 Secretary/Treasurer: Dave Kern, 5 Hilltop Drive, Manhasset, NY 11030

Reduced for Quick Sale: Waltham Thread Mill, $750 and Waltham Spur Gear Cutter, $750, the gear cutter headstock appears to take W15 collets. Mark Fulmer (330) 877-2021, Markusfu@hotmail.com

Ever wonder how watch jewels were made? Elgin Watch Factory Filmed the entire process and now it is available on CD. Send $13 to Chapter 173 in care of Dave Kern, 5 Hilltop Drive, Manhasset, NY 11030, Email: dkern@optonline.net

Watch Pivot Polishing Machine, from Bulova Watch Factory, $450, Bruce Forman, 234 Eagle Ridge Drive, Valparaiso, IN 46385, (219) 763-4748, email: forman21@netzero.net will sell or trade for antique tools I want but do not need.