EXAMINATION AND REPAIR OF THE TUDOR PLACE
1804 BROADWOOD SQUARE PIANO
ACCESSION NUMBER 4037
Draft Submitted April 17, 2012
Revised May 3, 2012

GENERAL

The 1804 Broadwood square piano belonging to the Tudor Place Foundation and former property of the Peter family of Georgetown, D.C. was initially examined on February 27 and March 12, 2012 in response to a query from the Tudor Place Foundation to ascertain the feasibility of using the instrument in a short concert late in the spring of 2012. During routine cleaning of the action, two original leather hammer shank hinges broke and were replaced, and parts of a missing music desk were reconstructed and installed. The pitch level of the instrument was raised to a = 392 Hz. and was stable by its fourth tuning on April 2, 2012. It was discovered that the piano's six-octave compass from DD to d^4 is unique among surviving Broadwood fortepianos. Under detailed examination, it was determined that most parts of the instrument are original and are in an excellent state of preservation. Prior refurbishments in the early 20th century did not obliterate details of construction or grossly violate conservation practices of the time.

DESCRIPTION AND PROVENANCE

Visual examination of the external casework of the instrument confirmed the existing catalogue entry data which includes date of manufacture, a compass of six octaves, length of 1274 mm, width of 661 mm, and height 813 mm. These are standard Broadwood dimensions for a six-octave square. The case is veneered with horizontal, mahogany panels surrounded by a wide stringing of boxwood and ebony followed by vertical crossbanded white wood. The piano's hinged lid, flap and lockboard are solid mahogany. The instrument rests on a Broadwood "French-style" stand consisting of an apron and four tapered legs, with inlay patterns and stringing on both members, with the legs capped with original square brass casters.[1] The keywell and cheeks are veneered in satinwood panels with thin ebony stringing and crossbanded with rosewood. The keylevers are limewood (visual observation) with natural keys topped with elephant ivory and accidentals with Gabon ebony.

The instrument is double strung throughout its compass with high tensile steel strings in the midrange and treble, and wrapped or overspun strings in the bass (both not original and were installed in 1929). A vertical, wooden support for a missing sustaining pedal mechanism is attached to the back side of the case and extends to the floor. The vertical support has three

[1] Michael Cole, *Broadwood Square Pianos* (Cheltenham, England: Tatchley Books, 2005), 85. According to Cole, Broadwood still supplied square pianos with what they called a "French frame' stand, with four square-tapering legs joined by stretchers on top until ca. 1810. By 1807, smaller instruments were made with six lathe-turned legs terminating in brass cup castors which "this drastically changed the look of the piano, so that within a couple of years instruments with square tapered legs began to look very passé."

holes which carried the brass hinge secured with screws to connect the support to the pedal. Armistead Peter 3rd's privately published monograph *Tudor Place* (Washington D.C. 1969) indicate that the instrument was purchased by Major George Peter (1779–1861) for the educational and social advantage of his daughters, and the instrument has remained in the family ever since. Peter writes:

> "On the other side of the room, opposite this piece of furniture, is a Broadwood piano, dated 1804, which was bought by my great-great-grandfather, Major George Peter, for his daughters, so that they might learn to play. This piano was at one time stored at the farm at Bethesda. It is another one of the group of which I have spoken earlier, that was badly stored and got into very bad condition because of dampness. When it came to my father I took it over to Mr. Rozinski [sic] and he did a perfectly marvelous job of reconditioning. That is the reason that you see the diagonal inlay underneath the top, because the top had warped to such an extent that he had to gradually bring it back to a flat condition and then put in those diagonals in order to hold it, but the result was perfectly miraculous and a tribute to him as a cabinetmaker. [2]

In 1929, the local cabinetmaker Maximilian F. Rosinski (1869–1962) indeed refurbished the casework, and he may have subcontracted the musical repair work to the firm E. H. Droop and Sons, 1300 G Street, NW—the largest and oldest music dealer in Washington. While the invoice for work from Rosinski does not survive, Armistead Peter, Jr.'s diary details that he reimbursed his son Armistead Peter, 3rd for repairs to the piano.[3] Rosinski completed the repairs by the summer of 1929, and Peter, Jr. recorded the instruments return to Tudor Place once again in his diary on July 12, 1929. Peter, Jr. writes, "Last week, Rosinski brought the little old (1804) piano back … Thanks to A. and C. they are in order again."[4] In August 1929, Armistead Peter 3rd paid $1,024.00 to Rosinski for refurbishment of this piano and a second antique mirror–a goodly sum in 1929.[5]

In his privately published monograph *Tudor Place*, Armistead Peter 3rd described Rosinski's repairs to the piano, noting:

> "When it came to my father I took it over to Mr. Rozinski [sic] and he did a perfectly marvelous job of reconditioning. … The reason you see the diagonal inlay [i.e. sawn kerfs

[2] Armistead Peter 3rd, *Tudor Place* (Washington, D.C.: Privately published, 1969), 34.
[3] Armistead Peter, Jr. *Diary 1929*. Entry for February 4, 1929. Courtesy, Tudor Place Historic House & Garden Archive, Ms. 14, Box 73, Folder 15. Peter, Jr. writes: "I wrote to Armistead and Caroline yesterday, and as the former had written me that he had sent the little piano to Rosinski to be put in order, I told them that this was to be my Christmas gift – I enclosed the check to them. I have long wanted to do this – but it was not a necessity, and therefore could wait. Nothing that they could do for me would give me more pleasure, for it is a lovely little heirloom and has many associations for me."
[4] Ibid, Entry for July 12, 1929.
[5] Check No. 2537 from Armistead Peter 3rd to M. F. Rosinski for the amount of $1,024.00. Dated August 17, 1929. Cashed August 29, 1929 by Riggs National Bank, Washington, D.C. Courtesy, Tudor Place Historic House & Garden Archives, American Securities & Trust, Box 2.

> and mahogany splines] underneath the top [i.e. lockboard], because the top had warped to such an extent that [Rosinski] had to gradually bring it back to a flat condition and then put those diagonals in to hold it."

The Droop firm probably re-glued and reinforced the wrestplank (pinblock) and the hitchpin rail to counter the case distortion from years of string tension. Three dowels, the ends of which are visible on the proper left side of the case, were drilled through the case into the hitchpin rail and glued for additional strength. The bottom of the instrument consists of two layers of one and one-half inch thick pine planks (72 mm total thickness) which may have separated due to case distortion, and the bottom layer was probably replaced in 1929.[6] The drilling for the above dowels destroyed veneer on the right hand case panel, requiring Rosinski to make and glue circular patches to cover the dowel's end at the case. Both left and right cheek pieces (next to the keyboard) had veneer patches probably to cover structural damage that was repaired by Droop and probably finished by Rosinski as piano dealers usually subcontract case rework and paint retouching.

It is also possible E. F. Droop & Company performed some major musical work to the instrument. It was first unstrung, a new wrestplank was made and installed and 5.5 mm diameter, drilled tuning pins were installed. The soundboard was heavily varnished and at least one wooden rib, or stifleboard, was added to the underside of the soundboard. The soundboard shows evidence of removal and reinstallation sometime in the past. Old cracks in the soundboard were not shimmed but standard restoration practice in the early 20th century would have included this. Varnish is found in these cracks as well as on the entire bridge and bridge pins. Again, not a standard practice for a piano dealer. There is also a good possibility that the soundboard was sanded prior to varnishing as it appears exceptionally clean and free from water stains and candle wax drippings. The instrument was restrung in modern high tensile steel music wire and the lowest octave in the bass was strung with close spaced copper wire wound over a steel core music wire. The installed strings do not exhibit fine workmanship as both the loops at the hitchpins and the windings on the tuning pins display a rather unskilled hand working with unfamiliar materials on an unfamiliar instrument. Preliminary research indicated E.H. Droop and Sons was the exclusive Steinway & Sons dealer in Washington since 1867 and thus well equipped to service current instruments.[7]

In *Tudor Place,* Armistead Peter 3rd tentatively suggested the William M. Knabe piano factory in Baltimore, Maryland had performed the 1929 refurbishment.[8] No documentation in the Tudor Place Archive has been found to support the attribution of restoration or repairs to the William M. Knabe & Co. factory. Furthermore, by 1911 Ernest J. Knabe, Jr. and his brother William Knabe were manufacturing upright and grand pianos from a new Ohio manufactory, and soon

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[6] It is interesting to note that original 18th-century Broadwood 5-octave square pianos had 48 mm thick bottom boards, whereas those made by his sons ca. 1810–15 had as little as 43 mm. Cole, 94.

[7] "E. F. Dropp & Sons Co. Get Behning Agency," in *The Music Trade Review* (1912): 25. Accessed via the Music Box Society International (www.mbsi.org) and the International Arcade Museum (www.arcade-museum.com), April 10, 2012.

[8] Peter 3rd, *Tudor Place,* 34. Peter writes, "The interior, of course, was also in very bad condition, and I sent that over to, I think, the Knabe factory in Baltimore, for reconditioning and restringing."

declared bankruptcy in 1916. The company's older Baltimore factory closed in 1930.

The rest of the instrument retains most of the 1804 materials as discovered when the instrument's action was examined on Monday, February 27 and Monday, March 2, 2012.

EXAMINATION AND TUNINGS

The first examination on February 27, 2012 showed a string tension that clearly resembled a musical scale and not random pitches. Many unisons (individual notes that have two strings) were nearly at the same pitch with minimal beat interference. The Tudor Place Curator Erin Kuykendall and Archivist Wendy Kail have no documentation of work done to the instrument since the Tudor Place Foundation assumed management of the property in 1983. This is difficult to reconcile with the musical scaling that one could hear when depressing keys while ascending the keyboard. According to Thomas Strange, it is possible for an instrument to maintain a semblance of scale over an extended period of time.[9] On the other hand, no tuning hammer or muting wedges have been found at the Tudor Place mansion. Two invoices from the Droop firm survive, displaying costs that are reasonable for tuning services during the Great Depression years.[10]

Existing pitch level as measured on an AccuTuner III was roughly 200 cents flat in the bass increasing to 350 cents flat in the midrange and 400 cents flat in the extreme treble. (100 cents is the width of a semitone, e.g. C to C#; an octave contains 12 semitone notes or 1200 cents). With advice and agreement from Ms. Kuykendall it was decided to try to set the pitch level to a = 392 Hz. which is two semitones below the standard pitch a = 440 Hz. It was decided that on 3/12 that the action, keyboard and keybed would be removed, photographed and cleaned prior to a first tuning known in the trade as a pitch raise.

Pitch levels in the 18th and 19th centuries both in Europe and the Americas were known to be much lower than today's standard pitch level of a = 440 Hz. In keyboard instruments this was due to the current tensile strength of the wire, which was far lower than the music wire of today. In the 19th century, the phrases "Philosopher's Pitch" and "Victorian Pitch" were used to describe then current pitch levels. Research using indirect methods has shown that pitch levels varied within different cities and regions during the early 19th century and alter rose to later rose to a = 429 Hz. and a = 435 Hz. by the end of the century. As the strength of the 1804 case in 2012 is unproven and the current strings are modern high tensile steel, a most conservative pitch level of a=392 Hz. was chosen to minimize the string band tension on the case and supporting members.

The instrument was thoroughly photographed and digital photos were sent to five square piano experts, Michael Cole, Colm O'Leary and David Hackett in England; John Watson,

[9] Personal correspondence with Thomas Strange. May 2012

[10] There are several invoices, dated ca. 1925 to 1932, from E. F. Droop written to Armistead Peter 3rd or his wife Caroline for tuning sessions, and this large company would have been able to execute the repairs to the piano in 1929. For example, on December 29, 1928 Droop charged Armistead Peter 3rd $3.50 for work to tune the piano three days prior. Courtesy, Tudor Place Historic House & Garden Archive, Ms. 21, Box: Bills and Receipts 1928 – 29, Folder: Miscellaneous 1928.

Williamsburg, VA and Thomas Strange, Easley, SC for review and comments. Early replies confirmed this was a genuine Broadwood square of 1804 with a unique six octave keyboard. All remarked on the compass of the instrument which runs from DD in the bass to d^4 in the treble. All five state that this compass was heretofore unknown–no other Broadwood (or other maker's square or wing-shaped grand) has a DD to d^4 compass. In the early 1790s a few six octave Broadwood grands were made but all had a compass of CC – c^4.[11] When this piano was made, a DD to d^4 compass may not have been unique; in 1804 Broadwood was making around nineteen square instruments a week. Today it is unique according to the computerized online catalogue of early fortepianos both wing-shaped grands and squares.[12]

During the week of March 5, a harpsichord tuning hammer was modified to fit the Broadwood's 5.5 mm tuning pins and a proposal from Cembaloworks of Washington was submitted to provide pitch raising services and construction of the missing parts of the collapsing music desk, both necessary for a short concert using the instrument in April 2012. Permission from the Foundation was received to proceed.

On March 12, the instrument was again examined, and in its toolbox storage area a piece of felt was cut to line it and prevent vibrations arising from anything stored there. A leather tab for lifting the access cover was also made to replace one that was missing.

Next, the nameboard was removed with the help of a reverse-acting bar clamp, and the batten in front of the keybed was removed with its four brass screws (not original). This revealed chalk marks on the keybed showing the location of six iron screws (not original) that hold the keybed in place. By removing the keylevers next to the chalk marks (located between key 3 & 4, key 34 & 35, and key 71), these screws were visible and then removed. To avoid damper interference with the strings when removing the action, a piece of plasticized paper was inserted between the dampers and the strings, then the entire action, keylevers and keybed were lifted up and carefully slid out of the instrument.

The keybed was carefully examined, photographed and confirms that the compass DD – d^4 was indeed original. All front rail and balance rail cloth punchings are modern; however the keylever back rest and hammer rest cloths may be original. Chisel marks from cutting the original front and balance rail cloth on the keybed are visible. The dampers were cleaned and oiled. On the right hand member of the keybed a serial number 8348 in ink was found with an illegible word in pencil above it. According to a Broadwood chart of serial numbers vs. year of manufacture, this number would place it in the third or fourth quarters of 1804. All keylevers, brass underhung dampers, "old man's heads" and damper arm shoulders are original. All hammers appear original but the lowest ten hammers have had lacquer applied to their striking face to increase the hardness of the hammer in an ill-founded attempt to obtain a brighter sound. Two hammer shanks ($d\#^3$ and e^3) appear to be replacements. The keylever touch weight has never been altered and small original lead weights are found in the keylevers. The action for the highest octave is a

[11] Cole, 73. According to Cole, "Broadwood also sold a few 6 octave grand pianos in the 1790s, extended in the bass as well as the treble, for which he charged 80 guineas." For example, one 'superbly ornamented grand piano' of 6 octaves sold on June 22, 1796 for £256 to the Spanish diplomat Don Manuel de Godoy.
[12] Personal correspondence with Mark Adler and Michael Cole. March 2012.

separate assembly that slides out of the case when the keybed is removed and fixed in place when the keybed is installed. The highest thirteen notes have no dampers by design. Very old parchment shims were found glued to the keybed's bottom around middle C.

After the action was removed the bottom of the instrument was examined. Ghost lines from the keybed showed that no other keybed had ever been installed in this instrument. Six additional screw holes each about 145 mm behind the six keybed screw holes were observed. It is Thomas Strange's opinion that screws were probably inserted at an early date to clamp and reinforce the baseboard layers which might have separated due to string band tension.[13] To avoid screwing into the keybed, each clamping screw was set back from the keybed screws towards the rear. Since the lower set of baseboards has been replaced, these screw holes do not extend into the lower level.

The action was cleaned, the plasticized paper reinserted under the string band and the action, keylevers and keybed were reinstalled. The final step was to reinsert the keybed screws and replace the keylevers removed to gain access to these screws. The treble and midrange keylevers proved easy to do. The bass keylevers were difficult to reinstall as the shorter keylevers in the bass provide less clearance between the dead man's head and the underside of the hammer shank.

Hammer shanks move up and down by means of an oil tanned goatskin hinge glued between a rebate or mortise in the hammer shank and the forward edge of the hammer hinge rail. During replacement of the FF keylever, the hinge for its hammer shank broke cleanly detaching the hammer shank from the hammer hinge rail, making the note FF unable to sound.

REQUIRED REWORK

On March 12, the first attempt to raise pitch was attempted. Pitch level was set at a = 392 Hz. No overcompensation was used. After tuning, the midrange sank about 50 cents, treble about 100 cents, and both were touched up. At this time Cembaloworks of Washington removed both the hammer shank with broken hinge for FF and the music desk rest from the back of the nameboard for transport to the shop to replace the hinge and reconstruct the missing music desk members.

Consultation with both John Watson and Thomas Strange indicated that the hinge remnant glued between the two pieces of the hammer shank should be removed using steam which will dissolve animal based gelatin glues without damage to the glued parts. Under the guidance and direction of Wolf Instruments in The Plains, VA, the hammer shank was subjected to a pinpoint source of steam in their shop. After ten minutes, the top and bottom hammer shank pieces fell apart revealing a shallow rebate cut into the upper hammer shank piece. This rebate provides a narrow ledge that holds a piece of leather no more than 1 mm thick when both shank pieces are glued together. The remnant hinge piece found in the rebate was removed with a chisel and bagged. A replacement piece of goatskin was obtained from Thomas Strange and the leather was first glued in the rebate and then both hammer shank pieces were glued together. The leather was left oversized to be trimmed later when the hinge was glued to the hammer hinge rail. It was Ms.

[13] Personal correspondence with Mark Adler and Thomas Strange. March 2012.

Wolf's speculation that possibly two glues were originally used, a fish glue for the rebate and hide glue to join the two hammer shank pieces together using just two small dots of glue to aid future hinge replacement as Broadwood knew was necessary from earlier instruments with failed leather hinges.

On March 16, with the action still in the case, the hammer hinge rail cover was removed after its holding screws (original) were removed. The hammer hinges were revealed and four replacement hinges were seen. Experts think that hinges were made up and glued as a single piece of leather, attached to a row of shanks, and then cut apart for each hammer.[14] As this was done, each separated hinge and hammer shank were numbered from bass to treble. These sets were made up before being assigned to a given instrument and in 1804 most Broadwood squares were five and one-half octaves with a compass of FF – c^4 and thus the lowest note FF would have its hinge numbered "1."

The 1804 Broadwood starts at DD and at the fourth note FF we find hinge number '1', which shows this instrument used a hinge set that started at FF with three additional hammer shanks and hinges <u>below</u> FF for DD, DD# and EE. Unfortunately these first three hinges are replacements, crudely glued over the original hinges thus obscuring their original numbers (if any). This does verify that this instrument had an unusual compass that required changes to existing production parts and assembly techniques as it underwent construction in the Broadwood factory.

All attempts to replace the FF hammer shank and hinge with the action in the case proved futile as the hammer head would not clear the underarm dampers while pushing the hammer from the front towards the back. In this attempt, the adjacent hammer's hinge (FF#) broke at its joint as well. It was replaced and re-glued the same day and in the afternoon, the action was again removed from the case and both hinges were glued back on the hammer hinge rail. Each hinge was labeled '2012' and photographed before and after replacement. Since there is no movement when the keybed is resting on the baseboards in the case, it was decided to leave the six keybed screws out of the instrument at this time and reinsert the action with all keylevers in place beforehand. These screws were stored in the tool box compartment.

<u>ADDITIONAL TUNINGS</u>

On March 17, the instrument was tuned again at a = 392 Hz and little sagging occurred. No string was more than 15 cents flat. Again most flattening had occurred in the midrange. At the first tuning it was noticed that the highest two notes $c\#^4$ and d^4 had a hammer misalignment problem. Due to slight case changes since 1929 or possibly before, these two hammers strike one string of their adjacent lower unison. As a result they cannot be tuned. As these notes would not be used in concert, this problem must be ignored in light of the suspected weakness in all the original hinges. If the hinges were new, the leather covers on the hammer head could be "coaxed" backward towards the rear of the case to miss the improper lower adjacent string. With 208 year old leather hinges this is too risky for these rarely unused notes.

[14] Personal correspondence with Mark Adler, John Watson, Thomas Strange, and David Hackett. March 2012.

Using auction pictures of 1808 and 1810 Broadwood square pianos with complete music desks, the length of the missing three vertical members and the horizontal connecting member could be determined and fabricated in the shop from a mahogany plank that matched the music stand rest in color and grain pattern (See Appendix C). A missing spacer for the middle vertical piece was also fabricated. The music desk forms a parallelogram that collapses into the left side of the instrument flush with the case top when the instrument is closed. Old scratch marks, screw holes and a positioning pin on the back of the music desk rest, determined the width and thickness of the missing members. Two of the three vertical members' attachment screws (original) exist and were reused. The new music desk members were brought to a medium gloss by repeated applications of Minwax's Antique Oil Finish and assembled with the existing piece to make a functioning music desk.

On April 2, the completed music desk was rescrewed to the back of the nameboard. The nameboard like many case parts was varnished in place, making the present removal and replacement difficult and left a hairline of varnish buildup where two surfaces touch each other. It was decided to lightly reduce the tenons at each end of the nameboard prior to reinsertion. The retaining mortises on each cheek were scraped to remove excess varnish and then waxed with paraffin. The tenons were lightly scraped with a razor blade and waxed as well. After three scrapings, the nameboard slipped easily into the case cheeks.

The instrument was then tuned for the fourth time at a = 392 Hz. and no noticeable pitch sag had occurred. The instrument is stable and structurally sound. Pitch level at the start of tuning was slightly sharp as the average daily humidity has increased with summer approaching. The crack in the bridge has not expanded nor have any tuning pins loosened in the wrestplank.

CONCLUSIONS

Though antique musical instruments are now rare, this 1804 Broadwood has received excellent and conservative treatment over the last 208 years. Reconstruction has been minimal compared to most salvaged instruments of this vintage. Today, much more is known about the materials and engineering found in Broadwood instruments. Of particular note is the metallurgy associated with 18th century wire drawing which has spawned a reproduction wire industry for early fortepianos and harpsichords alike. Reproduction wire was not available in 1929 and the heavier piano high tensile steel wire found on this instrument places undue stress on its case and prohibits the raising of its pitch level to a = 415 Hz. or a = 429 Hz - pitches which are required to play with other instruments. Wound wire has changed from loosely spaced overwraps to close spaced overwraps in a forty year period as the fortepiano evolved into the modern piano and the sound color (timber) produced by each is quite different. Some materials used by Broadwood have no modern replacement. Experts claim that the English fortepiano hammer head's outer leather cover consists of the vegetable tanned hide of an extinct Scottish goat breed! Today, oil tanned antelope hide is the most common replacement for hammer head refurbishment of early fortepianos. Early square pianos used whale baleen as a damper spring material - it cannot be harvested, imported or exported at all today by international treaty.

With yet another refurbishment, the 1804 can be made into a reliable playing instrument for

occasional use at Tudor Place well into the 21st century. In the unlikely event that the Tudor Place management might entertain this, a proposal could be developed describing work and costs involved to insure the instrument is playable for future musical events at Tudor Place.

Respectfully submitted,

/s/

Mark Adler
Cembaloworks of Washington

APPENDIX A

TUDOR PLACE CATALOGUE ENTRY FOR ACCESSION NUMBER 4037

- Serial Number: 8348 (found on the right hand member of the keybed on 3/12/2012).
- Date: 1804 (on nameboard cartouche).
- Compass: 6 octaves, DD to d^4 (thought to be unique amongst surviving Broadwood fortepianos).
- Overall Case Length: 1274 mm.
- Overall Case Width: 661 mm (measured at top of case)
- Overall Case Height: 813 mm.
- Keywell Length: 999 mm.
- Three Octave Span: 488 mm.
- Case: Oak (not observed) with mahogany veneer panels framed by boxwood and ebony stringing and crossbanded white wood on all four exterior sides with a music shelf attached to the hinged lockboard; pine nameboard with a satinwood veneer panel framed with thin stringing and crossbanded with rosewood. Fretwork panels are sawn near both corners and backed with red silk.
- Stand: Broadwood's "French" stand consisting of an apron and four tapered legs, inlay patterns and stringing on both, with original casters.
- Keylevers: Lime.
- Naturals: African elephant ivory (122 mm in length, 2.2 mm thickness at front of head, 1.6 mm at rear of tail).
- Accidentals (aka, sharps and flats): Gabon ebony (8.2 mm in length with slight taper in height from front to back)..
- Action: Non-accelerated hammer throw, no escapement, no backcheck, with brass underdampers.
- Strings: double strung throughout (restrung ca. 1929). DD to D strings are copper close-wrapped around a steel wire core; D# to d"" are steel (modern music wire as fortepiano reproduction wire was not available until the 1980's).
- Knee Levers: Not applicable to a square piano.
- Hand stops: Not used by 1800 by Broadwood. (The area formerly under the handstops became a tool box with lid to hold spare strings, tuning hammer and tuning wedges).
- Main Music Desk: A collapsing music desk was originally supplied. Only the music stand rest still exists. (Replacement parts were made in 2012).
- Sustaining Mechanism: Pivot bar, spring, rod and pedal are now missing and probably removed early in the 19th century: Support post at rear of instrument now remains.

STRING BAND SCALING

Measurements are for the longer string in the unison pairs.

DD string	1,494 mm	d" string	265 mm
D string	1,169 mm	d"' string	124 mm
d string	839 mm	d"" string	60 mm
d' string	515 mm		
c" string	301 mm *		

* c" is the standard string used to measure the scale of the instrument.

These measurements indicate that Broadwood intentionally positioned the bridge (an original feature) at the time of construction based on his standard scaling, as the length of the D strings are not the same length as C strings found on six octave square pianos. The Pythagorean stringing progression in the upper mid-range to treble is typical for all keyboard instruments since the 16th century.

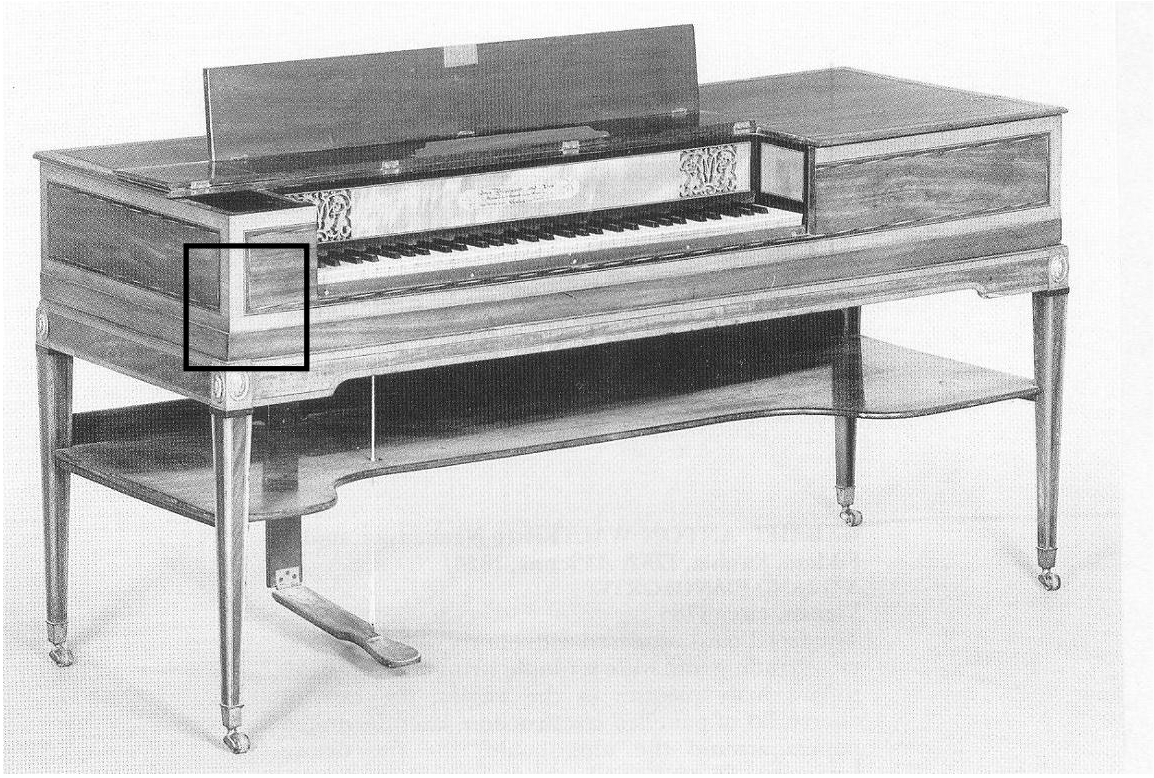
STRING BAND MATERIALS

From existing five and one-half octave instruments it is known that many had the lowest octave strung with wide spaced wrapped strings with a tinned copper wrap over a brass wire core for the lowest octave. Ascending in scale were solid cartridge case (70-30 alloy) brass strings followed by iron strings from the tenor region to the top.

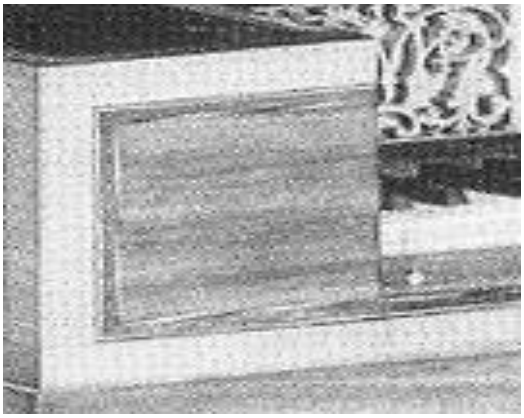
Original strings are rare and the 1804 has had its strings replaced at least once and is now strung in modern close wrapped strings in the bass and high tensile steel in the treble. This was probably done in 1929 and consistent with 20th century piano stringing practice.

APPENDIX B

DÉCOR AND STRINGING PATTERN ON AN 1806 BROADWOOD IDENTICAL TO THE 1804



Lot 161: Broadwood Square Piano
Auction House: Sotheby's, London
Date: November 18, 1993
Estimate: £3,000 - £4,000



Stringing pattern with undulating ribbons of boxwood and ebony – also found on the 1804 Broadwood square verifying that its stringing is original.

APPENDIX C

ADDITIONAL EARLY 19TH CENTURY PIANOS WITH MUSIC DESKS

Erin Kuykendall, Curator, found several comparable early 19th century Broadwood square pianos with music desks, including this 1808 Broadwood Square Piano which clearly shows this music desk as seen below.

Lot 493: 1810 Square Piano
Sale: European Furniture & Decorative Arts
Auction House: Skinner Auction
Date: April 9, 2011
Description:
Regency Ebony-inlaid Mahogany Square Piano, John Broadwood & Sons, London, c. 1810, "12938" written in pencil on the interior, with sheet music rest and storage compartment, on six reeded circular legs on casters, with manufacturer's instruction manual, c. 1900, ht. 31 1/2, wd. 65 3/4, dp. 24 3/4 in. 7 1/2 in. strip of veneer off but present, age typical cracks, nicks, and scratches to case and legs

Lot 275: 1808 Square Piano
Sale: European Furniture & Decorative Arts
Auction House: Skinner Auction, Boston, MA
Date: April 9, 2011
Description:
Georgian Mahogany Square Piano, John Broadwood & Son, London, 1808, serial number 12109, with sheet music rest and storage compartment, on six turned circular legs with castors, ht. 31 3/8, wd. 65 1/2, dp. 23 3/4 in.

RECONSTRUCTION OF THE MISSING MUSIC DESK MEMBERS

The Tudor Place 1804 Broadwood originally had two music desks, one for use when the lid was open, and a secondary one used when the lid was closed which was attached to the instrument's lockboard.

The main music desk was attached to the back side of the nameboard and designed to collapse

into the case so that the lid could be closed. By design this was a fragile item with thin uprights; it is easily broken and thus was missing when the instrument was examined in 2012. The music desk base remained attached to the reverse of the nameboard and consisted of a triangular piece of mahogany embedded with its original iron screws, a stop pin and scratch marks left by the original uprights now missing.

From scratch marks and original screw holes on the existing music desk base, the width of the three vertical members was found to be 17 mm. The length of these uprights was determined by measuring the ratio between the observed height of these members and the height of the nameboard from the picture above. With this ratio in hand and knowing the actual height of the 1804's nameboard, their length could be accurately determined. Since the music desk is a collapsing parallelogram, the length and width of the upright support members are geometrically related as the rectangle must fold down to the top of the case so that only the case sides support the lid when closed. The missing uprights and the top member connecting them were fabricated and attached to the existing music desk base. A small piece of buckskin was glued to the right hand upright to cushion the music desk when stopped by the pin in its vertical position. The entire assembly was then rescrewed to the back of the nameboard.

The newly reconstructed music desk for the Tudor Place 1804 Broadwood is shown below.