Pianos in the Smithsonian Institution

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COVER: Broadwood Vertical Piano, ca. 1815.
(Time-Life Photograph)

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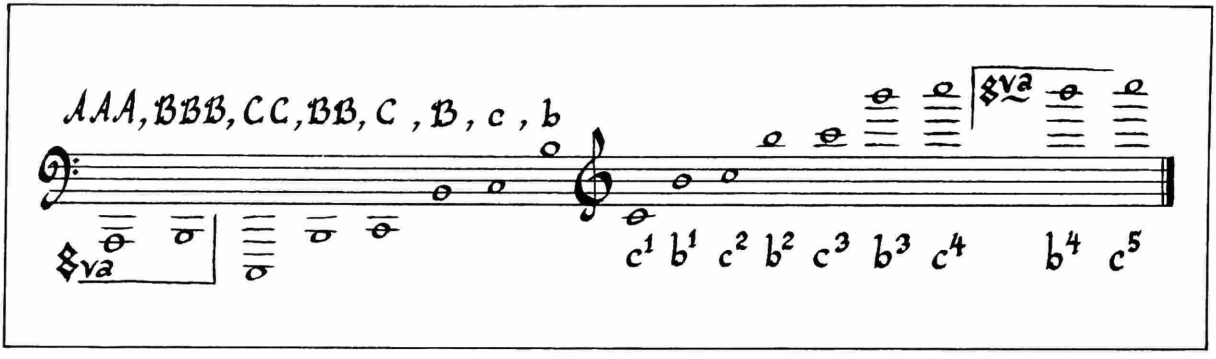


Explanation of keyboard compasses.

Pianos in the Smithsonian Institution

This booklet will serve as an introduction to the important collection of pianos in the Smithsonian Institution. As yet no catalog has been compiled and the collection is little known, but it is one of the largest collections of instruments of this family in existence. A complete list of the keyboard collection is found in A Checklist of Keyboard Instruments at the Smithsonian Institution. *It includes the predecessors of the piano, i.e., clavichords and harpsichords, along with a complete list of the pianos. The checklist is available from the Division of Musical Instruments, National Museum of History and Technology, Smithsonian Institution. The selected examples discussed and illustrated herein represent many important stages in the development of the modern piano from its early beginnings.*

Predecessors of the Piano

The clavichord and harpsichord were the stringed keyboard instruments in use from sometime in the fourteenth century until they were finally replaced by the piano around 1800.

The clavichord is an instrument of extremely delicate sound—the dynamic range has been described as "from almost nothing at the least to not very much at the most"—and its uses are limited to playing for ones own pleasure or for a few friends in an intimate setting; it cannot be heard as an accompanying or

ensemble instrument. In spite of its limitations the clavichord survived, especially in Germany, because its peculiarly expressive possibilities were much admired. Its very simple action consists of a balanced key lever with an upright strip of metal—a tangent—set on the rear. When the key is struck the tangent strikes a pair (usually) of strings and presses against them as long as the key is held down. The tangent's continued pressure on the strings, inhibiting their vibration, accounts for the very small sound. It is obvious, however, that, by striking the key with greater or lesser force, control and gradation of volume are possible. Further, since the performer is still in touch with the strings as long as he holds down the key, he can vary the pressure slightly, stretching and relaxing the strings, to cause a subtle fluctuation of pitch as well as to prolong the sound. This expressive effect is a kind of vibrato—the designation for which is the German word *Bebung*—unique among keyboard instruments.

The harpsichord and its smaller relatives, the virginal and spinet, make their music by plucking the strings. One or more "jacks" rest on the end of each key. These jacks carry plectra to pluck the strings when the key is struck. Since the plucking takes place at some distance from the performer, by remote control so to speak, he has virtually no power to vary the dynamics by altering the force with which he strikes the keys. Therefore, gradation of volume cannot be achieved. Nevertheless, throughout the four centuries of its use, the harpsichord was the only stringed keyboard instrument that could be used for accompaniment and ensemble music. Composers and performers alike found ways to compensate for its lack of dynamic coloration, and a magnificent body of solo literature was composed for it.

The history of the Smithsonian Institution's fine collection of keyboard instruments begins with the munificent donation in 1914 of a group of clavichords, harpsichords, and pianos. These

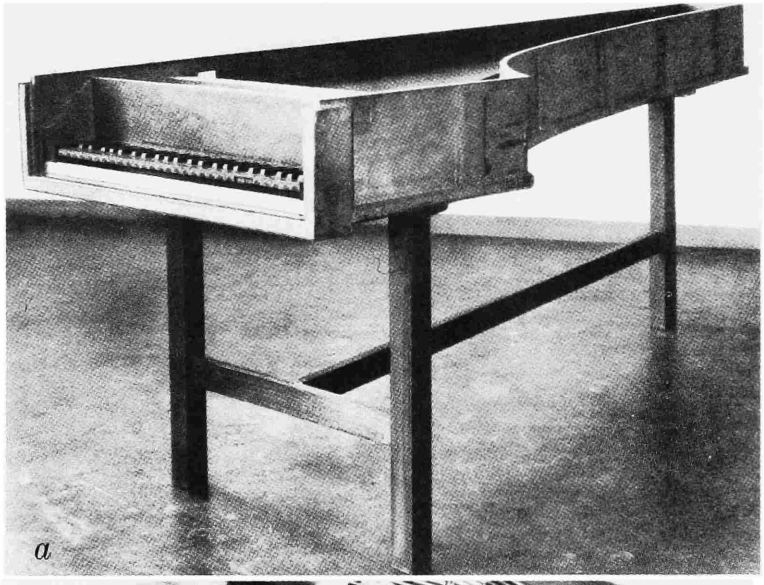
were the gift of Hugo Worch, a Washington piano technician and dealer. Before his death in 1938, he had augmented the collection to an impressive total of 170, 133 of which are pianos. Later donors have increased the number of pianos to 160.

The First Pianos

The early keyboard instruments served superbly for the music of their time, but from 1600 a slowly changing style of musical composition ultimately brought about a taste for an instrument with the expressive possibilities of the clavichord and the fuller sonority of the harpsichord. Shortly before 1700 an Italian harpsichord maker and keeper of the musical instrument collection of Prince Ferdinand dei Medici of Florence set out to "improve" the harpsichord and, quite inadvertently it seems, invented a new keyboard instrument. He called his invention "gravicembalo col piano e forte"—harpsichord with soft and loud. It was not a harpsichord at all, however, but the instrument we know as "piano" or, properly, "pianoforte," derived from Cristofori's descriptive name for his new instrument.

Three of Cristofori's pianos survive: one in The Metropolitan Museum of Art in New York City, one in the Museo Strumenti Musicali in Rome, and one in the Musikinstrumenten-Museum der Karl-Marx-Universität, in Leipzig, shown in Figure 1. The piano mentioned last is in its original state and reveals Cristofori as an inventor and consummate craftsman of great imagination.

In a case like that of a harpsichord, he substituted for the jacks with plectra a row of leather-topped wooden hammers and installed them in an ingenious mechanical system. Based on a series of levers, the action operates as follows: When a key is struck, a hammer is thrown up to strike two strings tuned in unison.



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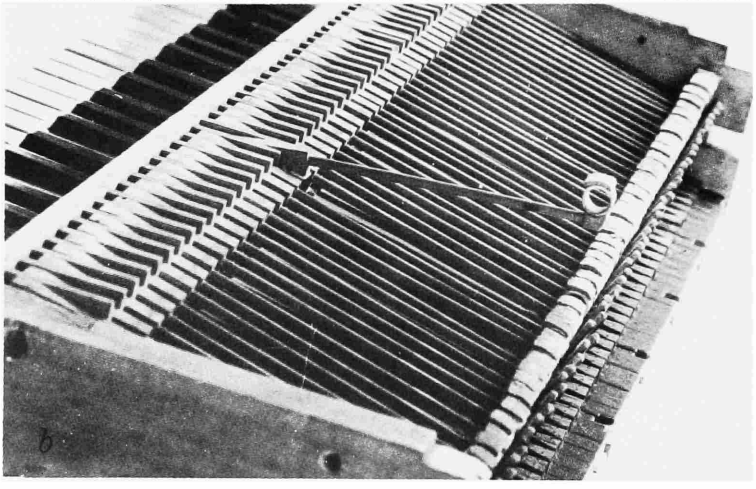

b

The final stroke of the hammer should take place from a point quite close to the strings, in order to give the player better control over the amount of tone he produces. The hammer having struck must then immediately drop away, leaving the strings free to continue vibrating while the key is held down. The part of the mechanism that controls the hammer's upward course and its rebound is known as the "escapement."

To refine the action, Cristofori installed behind the hammer an upright piece of wood covered with material to provide friction. This "check" or "backcheck" inhibits the hammer, when it falls against the check, from bouncing back to bob undesirably on the strings, stopping the tone.

He also installed a synchronized damper system—a pad of felt rests on each pair of strings until the instant before they are struck and then raises off to permit them to vibrate while the key is held down, returning to its position when the key is released.

A device (*una corda*) for shifting the keyboard so that each hammer strikes only a single string of each pair, was introduced to effect a contrast in dynamics as well as in tonal color.

(The term *"una corda"* (one string) is apt for the early double strung pianos where the device, whether lever or pedal, moves the action sideways so that the hammers strike only one of the two strings provided for each key. On the modern grand piano,

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FIGURE 1. Grand piano by Bartolommeo Cristofori, Florence, Italy, 1726. Compass C to c^3, double-strung. *a*, Full view. *b*, Action view. The hammer head consists of a small block of wood on which is set a hollow cylinder made of several layers of parchment topped with a pad of leather. The parchment roll is evidently intended to provide lightness and a certain degree of elasticity. (Musikinstrumenten-Museum der Karl-Marx-Universität, Leipzig.)

however, when the *una corda* pedal is in use, the hammers for the lowest single strings strike the strings off center; for the middle register they strike one of each pair of strings and in the upper register they strike two of the three strings for each key.)

The pianist of today will recognize that these features are all characteristic of the piano he plays; indeed, Cristofori's action is the basis of the modern piano and its principles have not been significantly changed.

The introduction of the piano was largely unnoticed. Although L. Giustini di Pistoja in 1732 wrote twelve sonatas for Cristofori's new instrument—the first-published music for piano—these almost forgotten compositions and the new instrument constitute Italy's total contribution to the history of the piano.

An Italian journalist, however, had visited Cristofori's studio in 1709 (the date most history books give for the invention of the piano) and two years later published an article describing and praising the remarkable instruments he had seen there.

Meanwhile, in Germany, a flamboyant performer on the hammered dulcimer had been exciting admiration. He was Pantaleon Hebenstreit who had had made a huge dulcimer strung with nearly 200 strings that he struck with two double-ended hammers —one end hard and the other padded. His dazzling virtuosity demonstrated the variety of sounds that could be produced by hammers striking strings with varying force. Hebenstreit's performance so intrigued Louis XIV in 1705 that the king suggested the gigantic dulcimer be called a "pantaleon" and so it came to be.

Others were also intrigued by the instrument, including Gottfried Silbermann, a clavichord- and organ-maker of Saxony, who applied his skill to making a few pantaleons. It is presumed that he learned of Cristofori's work from the article written by the Italian journalist—it had been translated into German—and

FIGURE 2. Grand piano by Gottfried Silbermann, Freiberg, Germany, ca. 1745. Compass FF to d^3. (Sans Souci Palace, Potsdam, Germany.)

it was thus a logical step to try his hand at a piano. Silbermann showed his first pianos to Johann Sebastian Bach in 1736, but was disappointed by his unfavorable criticism. Some ten years later, however, after dogged persistence, he produced an improved piano while retaining the principles of Cristofori's action. Silbermann's surviving pianos show that they indeed are worthy to succeed those of Cristofori. Frederick II of Prussia (later known as Frederick the Great) was so impressed that he ordered a number of them. Some reports say there were once fifteen pianos in his palaces; two are today in Sans Souci palace in Potsdam (Figure 2), and a third that disappeared during the second world war may still exist.

In 1747, Bach was invited to Potsdam by his son Carl Phillip Emanuel, who was in Frederick's service as chapel-master. Escorted around the palace by the king to try the pianos, the elder Bach apparently found them acceptable, but it must be considered that his complimentary remarks may have been made out of courtesy to the king. In honor of the occasion, however, Bach improvised a fugue on a theme provided by the king, later expanding it to his great work, "The Musical Offering." In any case, it is clear that during the few years left to him, Bach did not abandon the harpsichord and clavichord in favor of the piano as composers and performers were to do before the century ended.

Although other craftsmen had been experimenting in Germany, as well as in France, in attempting to make a hammer-action, stringed keyboard instrument—the piano idea was in the air—Silbermann was the most successful among them, and he is credited with the introduction of the piano in Germany.

Succeeding important stages in the development of the modern piano (examples of which are in the Smithsonian collections) are discussed in the following pages, along with some unsuccessful experiments of interest, as evidence of the inventive explorations

in the quest for a beautiful sound in an instrument that meets the requirements of composers and performers alike.

Developments in England and Germany

A piano built in 1711 by an English monk in Rome found its way to London and was copied there by an English harpsichord-maker. It met with no success, however, and was abandoned. The year 1760, then, marks the beginning of England's important role in piano-making history with the arrival from Germany of twelve men from Gottfried Silbermann's workshop, which had been closed due to the Seven Year's War. Most important among the arrivals was Johannes Zumpe, who found a job with the great Swiss-born harpsichord-maker, Burkat Shudi.

Zumpe knew piano-making in the Cristofori-Silbermann manner, and he soon set about making small compact pianos, rectangular in shape rather than the grand model. Since the pianos were modest in price as well as in size, they quickly caught on with the rising middle class and musical amateurs.

The first appearance of a piano in concert in London was in 1767 when a Zumpe was used to accompany a singer. The next year, the first public solo piano recital there was given by none other than Johann Christian Bach, Johann Sebastian's youngest son, who had taken up residence in London; and, again, a Zumpe piano was used.

The Zumpe rectangular piano (Figure 3) contained a simplified version of the action devised by Cristofori and Silbermann, but, lacking an escapement, it must have presented problems. Nevertheless, J. C. Bach managed to play admirably on it and, in fact, contributed greatly to the acceptance of the piano and the development of a true pianistic style.

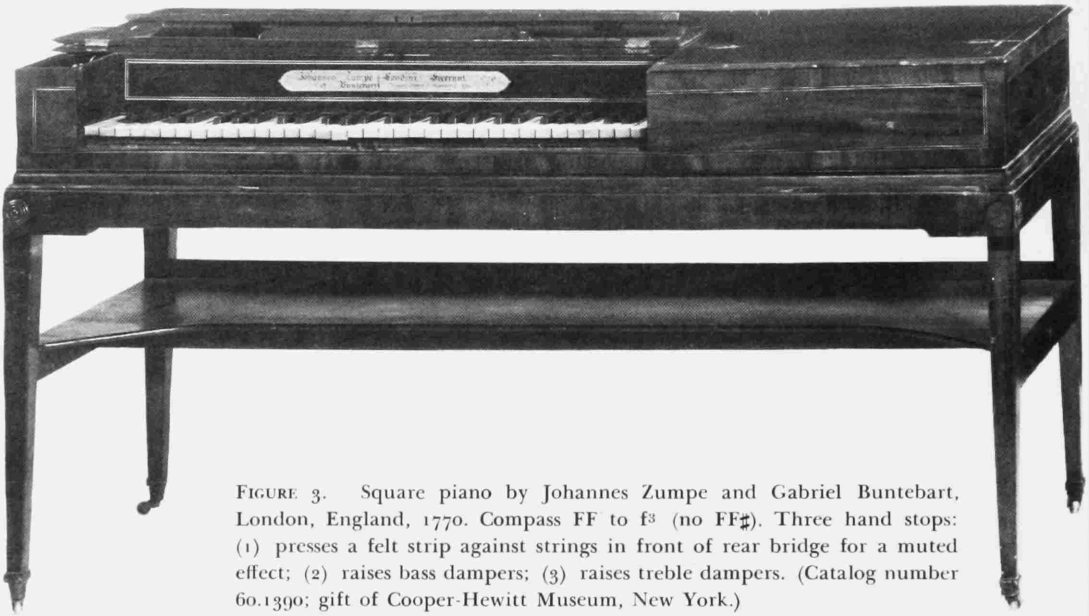


FIGURE 3. Square piano by Johannes Zumpe and Gabriel Buntebart, London, England, 1770. Compass FF to f^3 (no FF♯). Three hand stops: (1) presses a felt strip against strings in front of rear bridge for a muted effect; (2) raises bass dampers; (3) raises treble dampers. (Catalog number 60.1390; gift of Cooper-Hewitt Museum, New York.)

Soon the square pianos (as the rectangular models came inexplicably to be called) enjoyed a great vogue—Zumpe couldn't make them fast enough and others began to make them too. Before long they were also popular on the continent and influenced the beginnings of piano-making in France.

While the ideas of Cristofori were being developed by Silbermann in Germany and carried to England by Zumpe, another group in southern Germany was working independently in the interest of "improving" the clavichord.

The earliest known instrument of this type is a square piano by Johann Socher in 1742 now in the Germanischesmuseum,

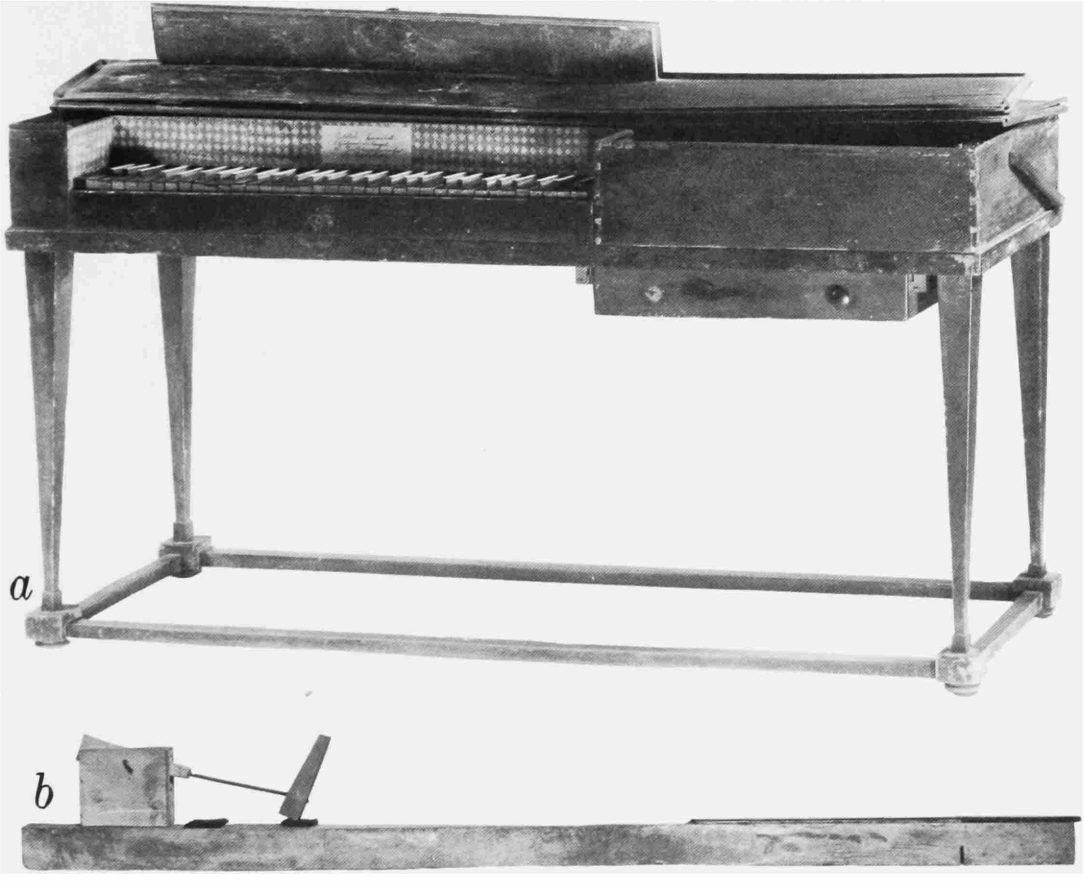


FIGURE 4. Square piano by Gottlob Emanuel Rüfner, Nürnberg, Germany, ca. 1780. Compass FF to g^3. *a*, Full view. Two hand stops: one raises dampers; the other is a buff stop moving leather tabs between hammers and strings. *b*, Detail of key and hammer (Catalog number 332,175; Hugo Worch Collection.)

Nürnberg. Its workmanship is of such sophistication, however, that it must surely have had predecessors. The piano shown in Figure 4, although later in date, is a primitive example that shows its close relation to the clavichord.

The case is so similar to that of a clavichord that it may once have even housed one, but it now contains the simplest of piano mechanisms known as *Prellemechanik* (rebound mechanism). Each hammer is pivoted on the rear end of the key in its own little housing (*Kapsel*), with the hammer pointing toward the front. The hammer is a wedge-shaped piece of uncovered wood. There is no escapement or backcheck, but since the hammer, once it has been thrown up to strike the strings, is free to rebound rather than continue to press against the strings as in the clavichord action, the instrument qualifies as a piano. The beginnings of this type of action are obscure, and one can only conjecture whether the first makers of these actions were conscious of having invented a new instrument or merely thought of them as altered clavichords as Cristofori thought of his piano as a new type of harpsichord.

The success of the piano had to await its acceptance by composers and performers. In the autumn of 1777, Mozart, then 21, was in Augsburg, Germany, where for the first time he played a grand piano made by Johann Andreas Stein. He wrote to his father praising the instrument and describing its superiority over the ones by Späth of Regensburg that had been his favorites. Later in the year his mother wrote from Mannheim to her husband that their son was creating a stir with his playing on the numerous pianos there—that indeed he was playing quite differently from the way he did in Salzburg.

Once a satisfactory piano was available, a style of composition idomatic for it quickly developed, and the harpsichord began to be neglected. In 1790, Joseph Haydn advised a friend to

follow his example by giving up his harpsichord and buying a piano. By 1800, the harpsichord was quite generally forgotten and the piano completely accepted.

The Schmidt piano in Figure 5 is, in all important aspects, like the Stein described by Mozart. It is likely that Mozart knew of Schmidt's work, as his father had recommended Schmidt as organ-builder to the Salzburg court.

FIGURE 5. Grand piano by Johann Schmidt, Salzburg, Austria, 1788. Compass FF to f^3. One hand (buff) stop (moves row of soft leather tabs forward to come between the hammers and strings), two knee levers under the keyboard (the right one raises the dampers from the right end leaving the bass strings partially damped; the left one raises the dampers from all the strings). (Catalog number 303,536; Hugo Worch Collection.)

British vs *Viennese Schools*

From the last quarter of the eighteenth century and through the nineteenth, two schools of piano-making vied for favor: the English Grand action (Figure 6), based on the principles of Cristofori and Silbermann, and the German or Viennese action (Figure 7), developed by German and Austrian makers. The former is more resistant to the touch, requires more muscle power, and produces greater volume; the latter is lighter in touch, more articulate, and more touch-sensitive.

Each school had its partisans and some makers produced both types in their workshops to satisfy their particular clients. There were even contests to prove the superiority of one over the other, but the results seem always to have been inconclusive.

As time went on, the aim of every piano-maker was to produce an instrument that combined the best qualities of each. For whatever reasons, the English system won out and the last Viennese action pianos were made in the early years of the twentieth century.

Johann Andreas Stein of Augsburg, Germany, whose piano Mozart enthusiastically praised to his father in 1777, was indeed a fine piano-maker as surviving examples of his instruments show, and he taught his craft to two of his children, Matthäus Andreas and Nannette. When Nannette married Johann Andreas Streicher in 1793, she moved with her husband, mother, and brother to Vienna. Sister and brother set up their own firm and it was then that the German piano action came to be known also as the Viennese action.

Nannette is the only woman to have distinguished herself in the field of piano-making and is remembered as a highly cultivated member of Viennese society, first-rate pianist, competent business woman, and devoted friend and confidante of Beethoven.

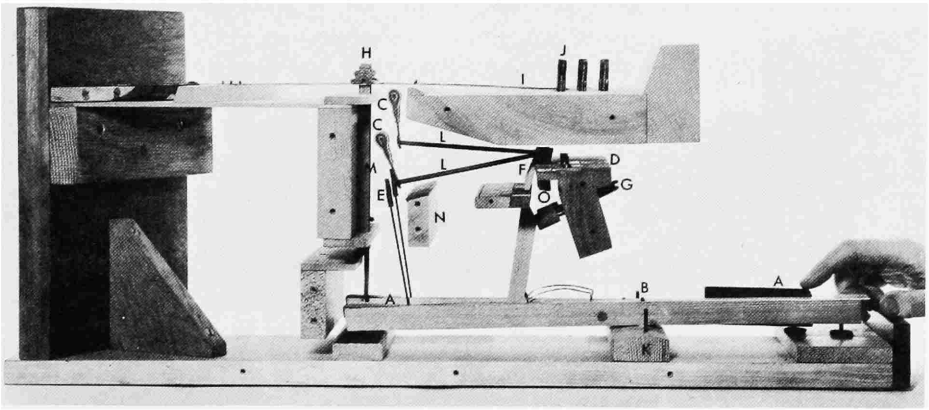


FIGURE 6. Model of English Grand action in the National Museum of History and Technology: A, keys; B, pins; C, hammers (the upper one arrested just before the final toss, the other arrested against the backcheck); D, portion of hammer rail; E, backcheck; F, escapement; G, screw to regulate escapement; H, damper; I, strings; J, wrest pins; K, fulcrum; L, hammer shanks; M, damper jacks; N, portion of hammer rest; O, notched block of wood.

The key (A-A) is a lever, one end of which is struck by the finger. It is held in place by a pin (B) on a fulcrum (K). The hammer (C) is set on the rear end of a hammer shank (L), the front end of which is attached to a small block of wood (O) pivoted to a hammer rail (D) that is part of the frame of the action.

Motion is transmitted to the hammer through the escapement (F), an upright attached to the key. The block of wood at the front of the hammer shank has a notch cut in it that rests on the top of this upright.

When the key is struck the escapement slides back under pressure from the regulating screw (G); when it finally slips out of the notch the hammer that had been traveling up makes its final toss to strike the strings (I). The control of the hammer's upward course until the last instant, that is accomplished by the escapement mechanism, gives the performer better control over the dynamics than would be possible if the hammer traveled freely from its rest. Once the hammer has struck, it drops back against the backcheck (E) and remains there as long as the key is held down.

Upon release of the key, the backcheck moves back allowing the hammer to drop down to its rest (N), and the escapement slips back under the notch in the block of wood as the rear end of the key descends.

The damper system consists of a jack (M) dropped through a mortise in the damper rail, its top capped with a pad of leather and felt (H). The jack is pushed up by the rear end of the key to lift the pad from the strings just before the hammer strikes them. It falls back of its own weight when the key is released.

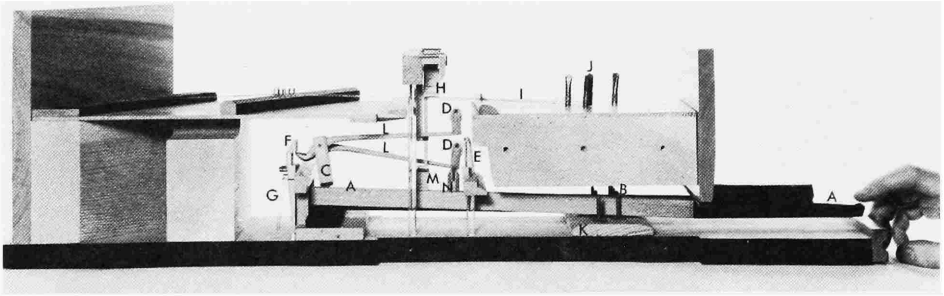


FIGURE 7. Model of German or Viennese action in the National Museum of History and Technology: A, keys; B, pins; C, Kapsel (hammer support or housing); D, hammers (the upper one arrested just before the final toss, the other at rest); E, backcheck; F, escapement; G, spring; H, damper jack; I, strings; J, wrest pins; K, fulcrum; L, hammer shanks; M, upright that raises damper jack; N, hammer rest.

The key (A-A) is a lever, one end of which is struck by the finger. It is held in place by a pin (B) on a fulcrum (K). The hammer (D) is on the front end of a shank (L) that is pinned at the other end to a Kapsel (C) fixed to the rear of the key. The shank terminates in a beak-shaped projection. The "beak" rests in a notch in the escapement (F) that is pressed forward at all times by a light spring (G). When the key is struck, the Kapsel rises carrying the hammer up and as the beak slips out of the notch of the escapement the hammer is freed to make its final toss to strike the strings (I). The control of the hammer's upward course until the last instant, that is accomplished by the escapement mechanism, gives the performer better control over the dynamics than would be possible if the hammer traveled freely from its resting place (N) to the strings.

Once the hammer has struck, it falls back against the backcheck (E), which is covered with material that provides enough friction to prevent the hammer from bouncing back against the strings, thus muffling the tone. The hammer rests there and the beak rests against the escapement above the notch as long as the key is held down. Upon release of the key, the hammer drops to its rest (N) as the escapement is pushed back into place by the spring (G).

The damper action consists of two parts: a short base of wood (M) cushioned with felt rests on the key and raises as the key is struck, pushing up a damper jack (H) to which is attached a thick pad of felt. The felt lifts from the strings the instant before the hammer strikes. When the key is released the jack falls down of its own weight, the felt pad coming to rest again on the strings.

In 1802, the partnership of the Steins was dissolved, each setting up on his own, Andreas using the French form of his middle name, André, and his sister signing herself Nannette Streicher *geborene* (born) Stein.

The piano shown in Figure 8 is a handsome example of André Stein's work and typical of the nineteenth-century Viennese piano. The rounded case, mahogany veneered with ormolu

FIGURE 8. Grand piano by André Stein, Vienna, Austria, ca. 1825. Compass FF to f^4. Four pedals: damper, bassoon on lowest three octaves (lowers a wooden bar on the under side of which is attached a roll of paper that touches the strings which, when struck, make a buzzing sound in attempted imitation of a bassoon); buff (moves soft leather tabs forward to come between hammers and strings); and *una corda*. (Catalog number 316,467; Hugo Worch Collection.)

FIGURE 9. Giraffe piano by André Stein, Vienna, Austria, ca. 1810. Compass FF to f^4. Six pedals: damper, bass drum and bells (one pedal), buff (two pedals, one of which places a felt strip between hammers and bass strings; the other operative on the treble strings), bassoon (lowers a bar with a roll of paper attached to the underside that touches the bass strings which, when struck, make a buzzing sound), *una corda*. (Catalog number 299,844; Hugo Worch Collection.)

decorations applied to the keyboard surround, is of striking elegance.

* * *

One of the more bizarre chapters in the history of the piano is the installation of multiple pedals for extravagant effects. These are known as Janissary pedals, taking their name from the Turkish Janissary bands that marched to the din of banging, clanging, and jangling of various percussion instruments—triangles, bells, cymbals, and drums. Fascination with these exotic sounds led to a fad; rulers in other countries organized their own noisy bands in the Turkish style and notable composers including Mozart and Beethoven wrote some music imitating the Janissary style.

The piano was not to escape this influence and from the beginning of the nineteenth century for about forty years a number of makers provided pedal attachments—as many as seven or eight—to produce a variety of percussive effects. The taste for these was often accompanied by a preference for a case in a style known as "giraffe"—a vertical piano in which the case follows the outline of the frame as in Figure 9.

The Janissary pedals were frivolous toys, an insult to the piano, and were deservedly abandoned and forgotten. They are included here only because they are a historical curiosity.

The Broadwood Piano

In 1761 Burkat Shudi, the esteemed London harpsichord-maker who had emigrated from Switzerland, took a young Scot, John Broadwood, as his apprentice. Broadwood married the Shudi daughter in 1769, and the next year his father-in-law made him a partner in the business.

Shudi retired in 1772 and died a year later, but the shop continued to make fine harpsichords under the name Shudi and Broadwood until 1791. Shudi's own son had remained with the business until 1782, in which year Broadwood became the sole proprietor, later taking both of his sons into partnership. The last harpsichord left the shop in 1793, bearing only Broadwood's name.

Well before this, however, Broadwood had turned to piano-making. As early as 1773 a square piano of Johannes Zumpe's model had been made in his shop and by 1780 Broadwood produced a model of his own.

The piano in Figure 10 is dated 1794 and must have been one of the earliest to be labeled "John Broadwood and Son." The case is in the style of one of the firm's harpsichords. Even the foot pedals are in the same design as those applied to the late harpsichords for a quite different purpose. The piano contains the English Grand action (Figure 6), as developed in the Broadwood shop by several craftsmen and based on the pianos of Cristofori and Silbermann. The soundboard bears the seal of England around which an inscription proudly proclaims: "By special appointment to H.M. King George III."

Since every great pianist has played a Broadwood, the name is famous. The Broadwood firm made history of a special nature when in 1817 it presented Beethoven with one of its grand pianos, his first with a compass of six octaves.

The presentation was ceremonious: Beethoven's name was inscribed on a special plaque that bore the name of Thomas Broadwood as donor, along with names of musicians of note in London at the time. Although it took seven months for the gift to reach Vienna, Beethoven was so impressed by the honor it represented that even before its eagerly awaited arrival on June 18, 1818, he wrote—in his best French—a florid letter of

FIGURE 10. Grand piano by John Broadwood and Son, London, England, 1794. Compass FF to c^4. Two pedals: damper and *una corda*. (Catalog number 303,530; Hugo Worch Collection.)

thanks to the donors. It is sad to relate, however, that his tragic deafness had progressed to such a point that it is unlikely he could hear the instrument; he had by this time, virtually given up playing. Nevertheless, to the end of his days he continued to take great pride in showing his Broadwood to visitors. Ultimately, the piano came into the hands of Franz Liszt and is now in the Magyar Nemzeti Muzeum in Budapest. John Broadwood and Sons Ltd., continues in business in London and is operated by descendants of the founders.

Vertical Pianos

The rise of a prosperous middle class was accompanied by the advent of the musical amateur and as more and more people wanted pianos, makers began to give some thought to making them in new shapes. The horizontal grand piano took up too much space for the average modest home and the small square pianos with limited soundboard space were inadequate for ambitious virtuosos. Some makers thought of upending small grands and setting them on stands. Others simply turned small squares on their sides and set them on stands.

A vertical piano requires a change in the action. Since the fall of the hammer is not aided by gravity, some kind of spring arrangement must be devised to ensure the prompt return of the hammer once it has struck the strings. Numerous makers attacked this problem in many different ways.

The instrument we know today as the "upright" was first developed by two makers in the same year—1800. They were Matthias Müller of Vienna and John Isaac Hawkins, an Englishman working in Philadelphia.

Each maker turned the piano on its end, rested it on the floor rather than on a stand, and ran the strings all the way to the bottom of its rectangular case. Hawkins then installed a type of action which, in principle, is down-striking but, in an upright instrument, becomes of necessity front-to-back-striking. Various makers had experimented with down-striking action for grands without success, so that the up-striking action was universally adopted for these models. The down-striking action, however, became standard for uprights.

Müller's piano was not widely noticed and Hawkins is generally credited with the invention of the piano we now call the upright. The neat little cabinet piano attracted a good deal of

attention at the time, and it was played in a concert at the Franklin Institute of Philadelphia. While on a visit to that city, Thomas Jefferson was so taken with the little piano that he bought one for Monticello—only to return it to the maker with the complaint that it would not stay in tune.

Running the strings all the way to the floor is an advantageous utilization of the available space. In 1802 a London manufacturer thought of making even better use of the space by running the strings obliquely across the frame, making it possible to use longer bass strings for a better sound.

Of more interest, however, than the stringing plan is Hawkins' use of metal somewhat in advance of his time. The soundboard is suspended in a metal frame braced by iron bars and the bass strings are overspun or wrapped, substituting thickness and weight for length. Metal framing and overspun bass strings were to become very important to the piano of the future, as described on pages 36, 37.

Figure 11 shows the exterior and stringing of a Hawkins upright piano made in 1801. Although it is numbered 6 the only other example known to exist is in the collection of John Broadwood and Sons, Ltd., London, and dates from 1800.

Along with the innovations introduced by Hawkins, his little piano has some features that are throwbacks to earlier times. The natural keys are capped with boxwood and the accidentals are black, as were those of early harpsichords, and there is a "Venetian Swell" for dynamic effects. This latter was invented in 1769 by Burkat Shudi to be applied to harpsichords. It is a row of louvers set over the soundboard, the opening and closing of which are controlled by a pedal attachment. It was not very successful for harpsichords, but organ makers adopted the device to good effect and a few square pianos were so equipped around the turn of the century.

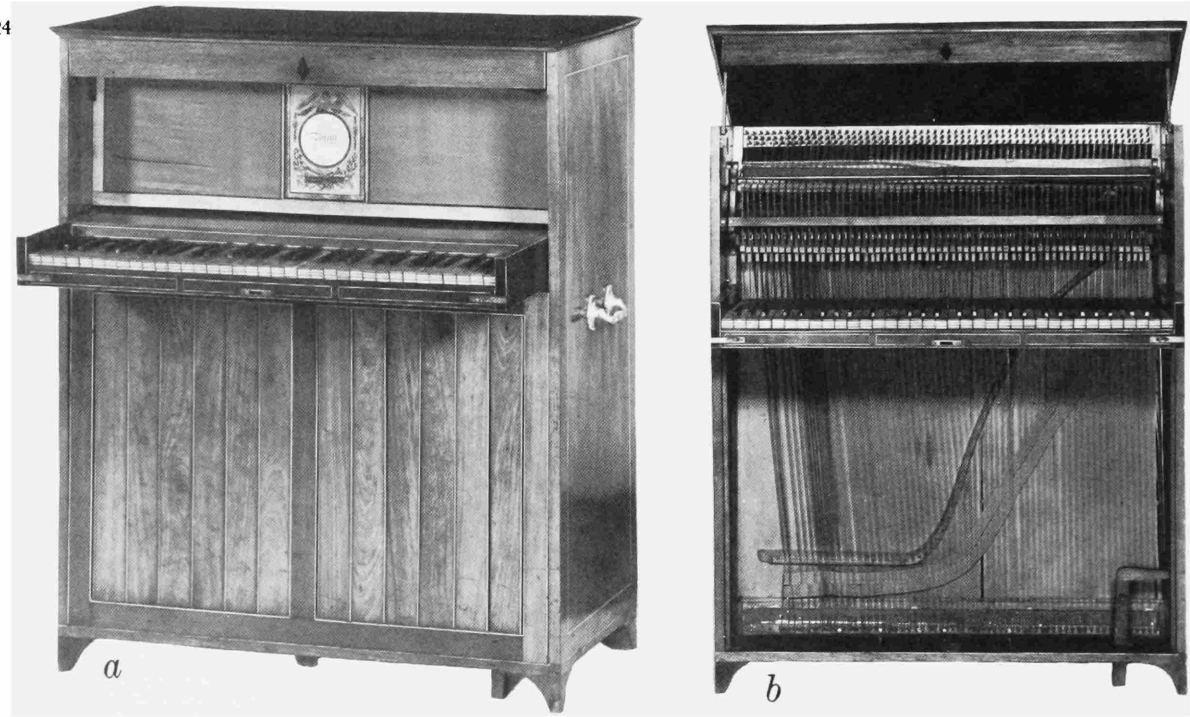


FIGURE 11. Upright piano (called portable grand) by John Isaac Hawkins, Philadelphia, 1801. Compass FF to f^3. *a*, Full view. Two pedals or levers, which move from side to side—one to open and close the Venetian swell, the other a buff stop. The keyboard folds up, making a neat little portable cabinet. *b*, Plan view. (Catalog number 313,619; Hugo Worch Collection.)

Hawkins cabinet piano had no significant impact on the development of the piano; still his instruments incorporate some noteworthy ideas. Primarily an inventor rather than a musical instrument-maker, he deserves notice for his wide range of in-

terests. Besides conceiving a number of ideas aimed at improving the piano, he invented a musical instrument called the "claviola," an example of which is in the collection of The Metropolitan Museum of Art. An igenious novelty, it consists of a small keyboard (two octaves and four notes) to which is attached an upright soundboard shaped like a viol. It has twenty-five strings, in front of which a sliding brass rod holds a bow. When a key is struck, it raises a string that is pressed against the bow. It is thus a bowed-stringed keyboard instrument. Although the maker boasted of its remarkably expressive possibilities, it was not successful. Musical instruments, however, were by no means his only concern. He once laid down a short railway in Regents Park, London, to try out a differential pulley. Involved were a railway carriage and a horse to demonstrate that, with the aid of a pulley, a horse could propel the carriage ten times as far as he moved. He and a friend patented the "physiognatrace" for the purpose of tracing on paper the outline of a person, and, more modestly, it is claimed he invented the self-sharpening pencil.

Another version of a vertical piano was brought out by John Broadwood, who borrowed the idea from another Englishman, Robert Stodart. The two were no doubt thinking back to the clavicytherium or vertical harpsichord that is simply a conventional harpsichord turned up and set on a stand, with the action adapted for the changed direction. It is likely neither maker knew the upright pianos of Müller and Hawkins.

The rectangular frame of the Broadwood piano in Figure 12 houses a small grand piano turned up and set on a stand. In the space left by the bentside, shelves for books or music are conveniently provided. A parchment cover protects the soundboard from dust, and this in turn is concealed behind a pleated screen of garnet-colored silk topped by a swag. It is more than

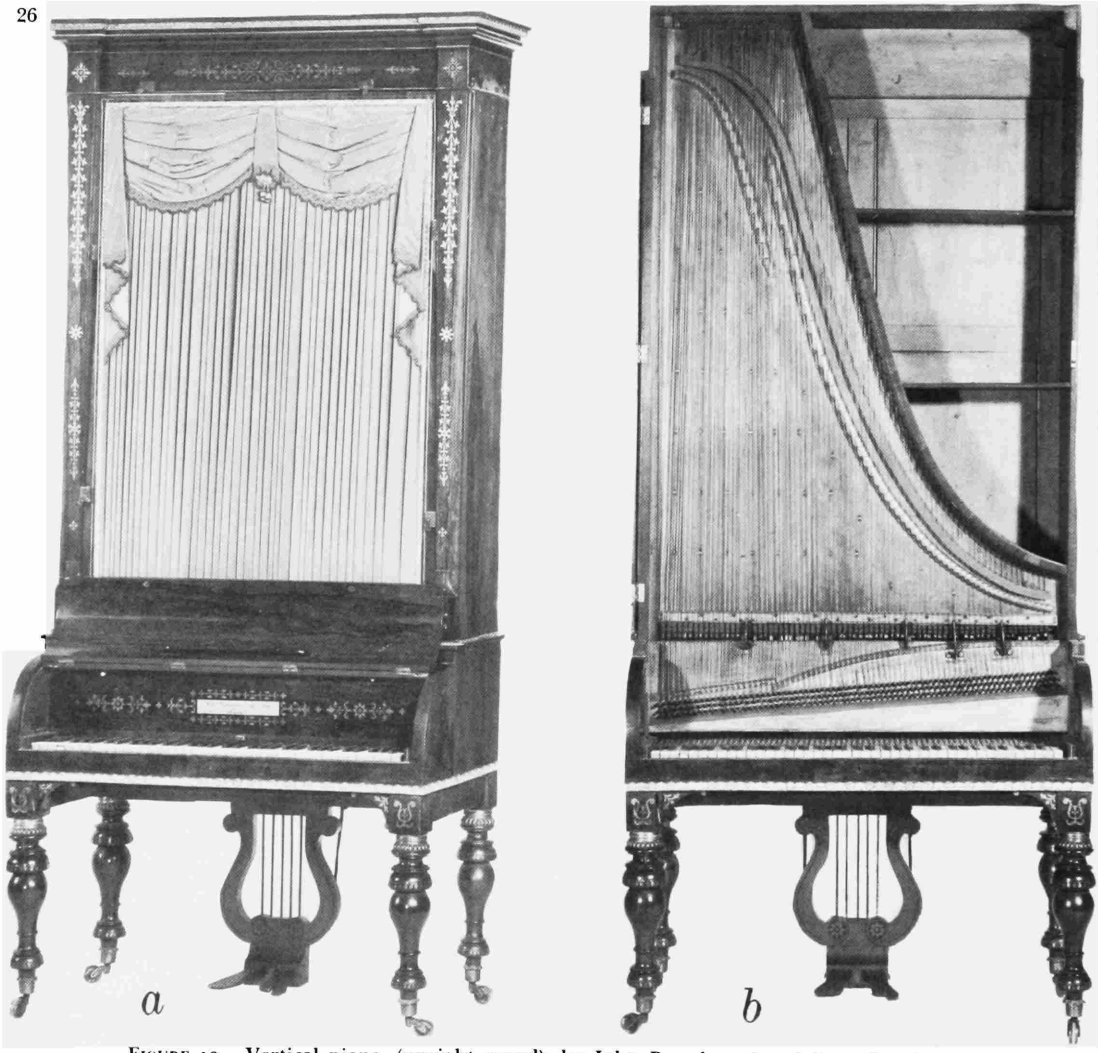


FIGURE 12. Vertical piano (upright grand) by John Broadwood and Sons, London, ca. 1815. Compass CC to c^4. *a*, Full view. Two pedals: split damper pedal (one half raises dampers from bass strings, the other from treble strings) and *una corda*. *b*, Plan view with music shelves. (Catalog number 303,529; Hugo Worch Collection.)

8½ feet tall, and the stand and frame are of rosewood tastefully ornamented with stenciling in gold paint and applied ormolu moulding. Although top-heavy, it must have been a striking addition to a nineteenth-century upper middle-class English parlor. Joseph Haydn had admired a similar one by Stodart in 1795.

As for the action, the hammers strike from behind through a slot between the soundboard and wrestplank on the same principle as the up-striking action of the modern grand. As previously noted, however, modern uprights work on the principle of a down-striking action.

About 1812, a vogue developed in England for very small upright pianos. They were designated by various names such as "cottage," "cabinet," and "pocket grand horizontal." These miniatures were imitated by European makers, including Pleyel of France, who called them "Pianinos." The pretty, extravagantly decorated little piano in Figure 13 is such a one. It is covered with red imitation tortoise shell and brass inlay and has ornate brass candle holders with pink glass shades and brass handles on the sides for moving it easily.

French Contributions

Three names stand out in the history of the piano in France: Sebastien Erard, Jean-Henri Pape, and Ignaz Pleyel. In 1777, Erard made the first successful French piano—a square model. Having come to Paris from his native Alsace, he had been apprenticed to a harpsichord maker. He must have seen the Zumpe pianos, which had become popular in France, for his pianos follow the English plan. His later invention of the "repetition" or "double escapement" mechanism (pages 39, 40) became a

characteristic of future pianos. The Smithsonian's collection contains a square model by Erard dated 1799.

The earliest pianos had hammers covered with leather (deerskin was favored). Having experimented for some time with improving the covering for hammers, Jean-Henri Pape produced, in 1839, tapered layers of treated felt with the desired elasticity and resilience. English and continental piano makers soon adopted felt-covered hammers, and by the 1850s leather-covering was abandoned. German piano makers were the last to accept the new style hammers, but they are in universal use today.

Ignaz Pleyel of Austria founded his piano factory in Paris in 1807 after a distinguished career in musical performance and composition that included study with Joseph Haydn and official musical posts in Strasbourg and London. After seventeen success-

FIGURE 13. Small upright piano by Pleyel, Paris, France, ca. 1858. Compass AAA to a^4. Two pedals: damper, *una corda*. (Catalog number 291,775; Hugo Worch Collection.)

ful years he turned the business over to his son, Camille. The son, also a musician, was a thorough student of the craft of piano making and an intimate of the great musical personnages of his day including Frédéric Chopin. Chopin is said to have been fond of Pleyel instruments for their "silvery and somewhat veiled sonority and their easy touch." Indeed, a Pleyel enjoys the same status in France today as does a Steinway in this country. Pianists find them especially congenial for performance of French music. The Smithsonian collection includes a Pleyel grand of 1867 in addition to the little upright in Figure 13.

American Innovations

The first pianos in America were English, brought by early settlers or sent over later. Although there was a lively importation of pianos, by the last quarter of the eighteenth century a native American industry was getting under way. The earliest of the American-made pianos were, as might be expected, copies of imported English instruments and hardly distinguishable from them.

Probably the first piano made in the New World was that by John Behrent of Philadelphia in 1775, and by the 1780s several makers were working in New York as well. From 1800 on, Boston was an important center of the industry and remained so for nearly a hundred years.

One of the best of the Philadelphia makers was Charles Albrecht. Figure 14 shows an English piano such as Albrecht and others used as models and Figure 15 is one of Albrecht's own instruments. The close similarity of the two is obvious, but it was not long before American makers departed from slavish imitation and began to introduce original ideas and improvements to their craft.

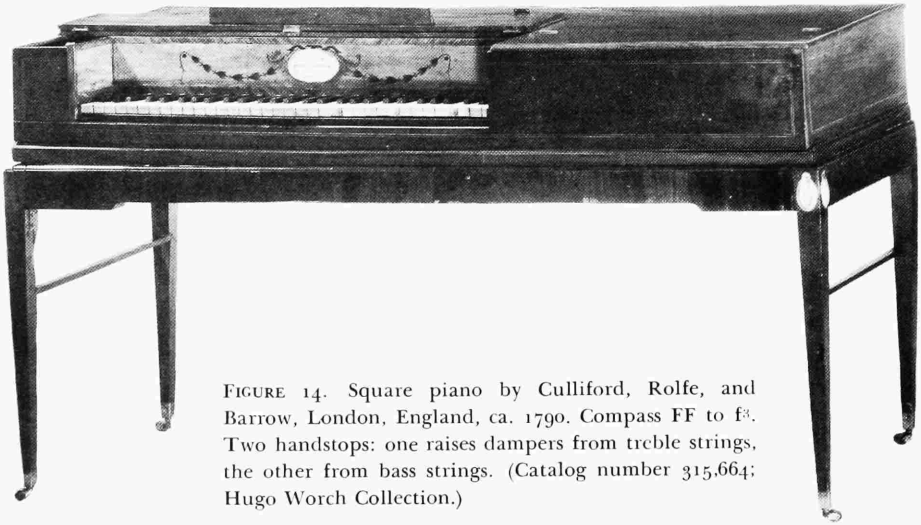


FIGURE 14. Square piano by Culliford, Rolfe, and Barrow, London, England, ca. 1790. Compass FF to f^3. Two handstops: one raises dampers from treble strings, the other from bass strings. (Catalog number 315,664; Hugo Worch Collection.)

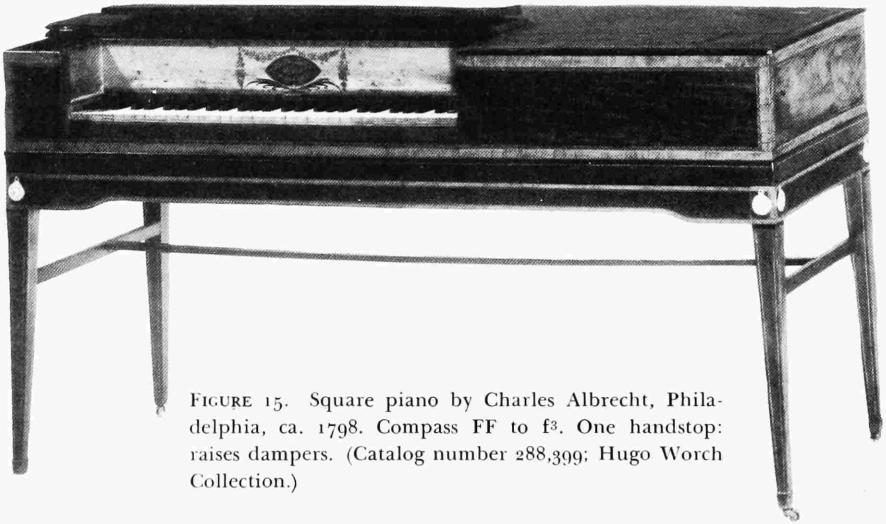


FIGURE 15. Square piano by Charles Albrecht, Philadelphia, ca. 1798. Compass FF to f^3. One handstop: raises dampers. (Catalog number 288,399; Hugo Worch Collection.)

Once launched, the industry developed spectacularly and after the middle of the nineteenth century the United States assumed a position of leadership. It was to make contributions of great significance to the development of the piano.

The nineteenth century saw the development of a style of composition and performance that exploited the full possibilities of the piano. Early in the century it became apparent that the light wood-framed piano was not sturdy enough for the increasing demands being made upon it. Heavier stringing and greater tension on the strings were among the changes made in the interest of producing a more brilliant and powerful instrument. The keyboard compass of five octaves that prevailed through most of the eighteenth century was gradually increased to reach, in the 1870s, the 88 keys of the modern piano. Pitch, not yet standardized and as low as 409, was creeping up slowly to be established, finally, in the twentieth century, at 440. (These figures refer to the number of cycles or double vibrations per second at "tuning A," i.e., the A above middle C.) Pulling the strings up to a higher pitch put more strain on the frame.

The heroic style of performance inaugurated by Beethoven and carried to its ultimate by Franz Liszt made assaults on the piano that jarred it out of tune and actually broke strings in the middle of a concert. The answer to the problems seemed to lie in reenforcing the frame with metal rather than wooden struts.

Hawkins' tentative use of metal in the frame of his little portable piano (Figure 11) seems to have gone unnoticed, but English makers were experimenting with reenforcing metal bars, tubes, or plates of various kinds. Much credit for the solution, however, must go to American makers.

Two Bostonians took significant steps. In 1825, Alpheus Babcock patented a tubular metal frame cast in one piece with the hitch-pin plate for a square piano (Figure 16). Perhaps it

FIGURE 16. Square piano by Alpheus Babcock, Philadelphia, Pennsylvania, ca. 1835. Compass FF to f^4. *a*, Full view. Two pedals: damper and buff (slides soft leather tabs between hammers and strings). *b*, Plan view showing tubular metal frame. (Catalog number 315,690; Hugo Worch Collection.)

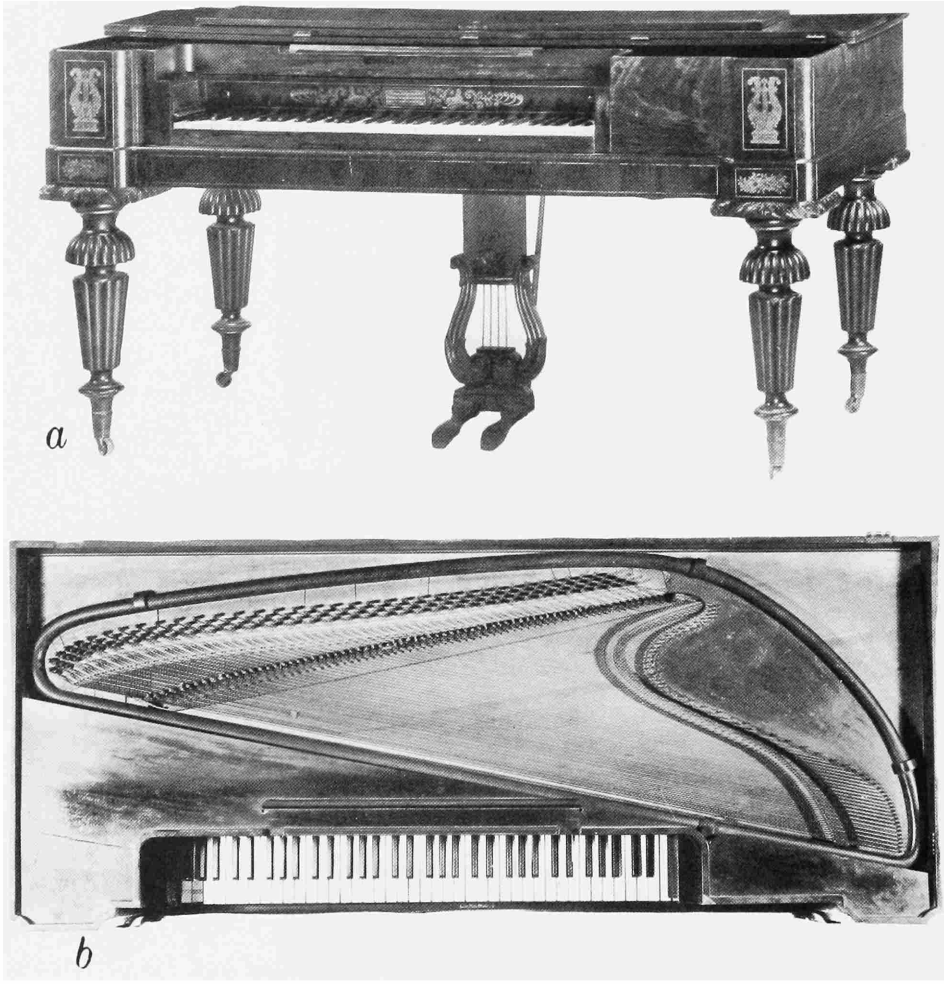


FIGURE 17. Square piano by Jonas Chickering, Boston, ca. 1828. Compass FF to f^4. *a*, Full view. Two pedals: one raises dampers from treble strings, the other from bass strings. *b*, Plan view showing metal hitch-pin plate. (Catalog number 70.19; gift of Mrs. Alfred M. Rankin, Jr.)

FIGURE 18. Square piano by Chickering, Boston, 1850. Compass CC to c^5. Two pedals: damper and buff (moves felt tabs between hammers and strings). (Catalog number 68.5; gift of the Honorable Richard P. Butrick.)

gave Jonas Chickering, originally from New Hampshire, the idea for a light perforated metal hitch-pin plate in a square piano he made about 1828 (Figure 17). In 1840 Chickering went further and patented an improved cast-iron frame for a square model shown in Figure 18 and in 1843 for the grand. His iron-framed instruments won the highest awards in the International Exhibition held in the Crystal Palace in London in 1851 and before the end of the century every great pianist from Franz Liszt to Louis Moreau Gottschalk of New Orleans had played and extolled them.

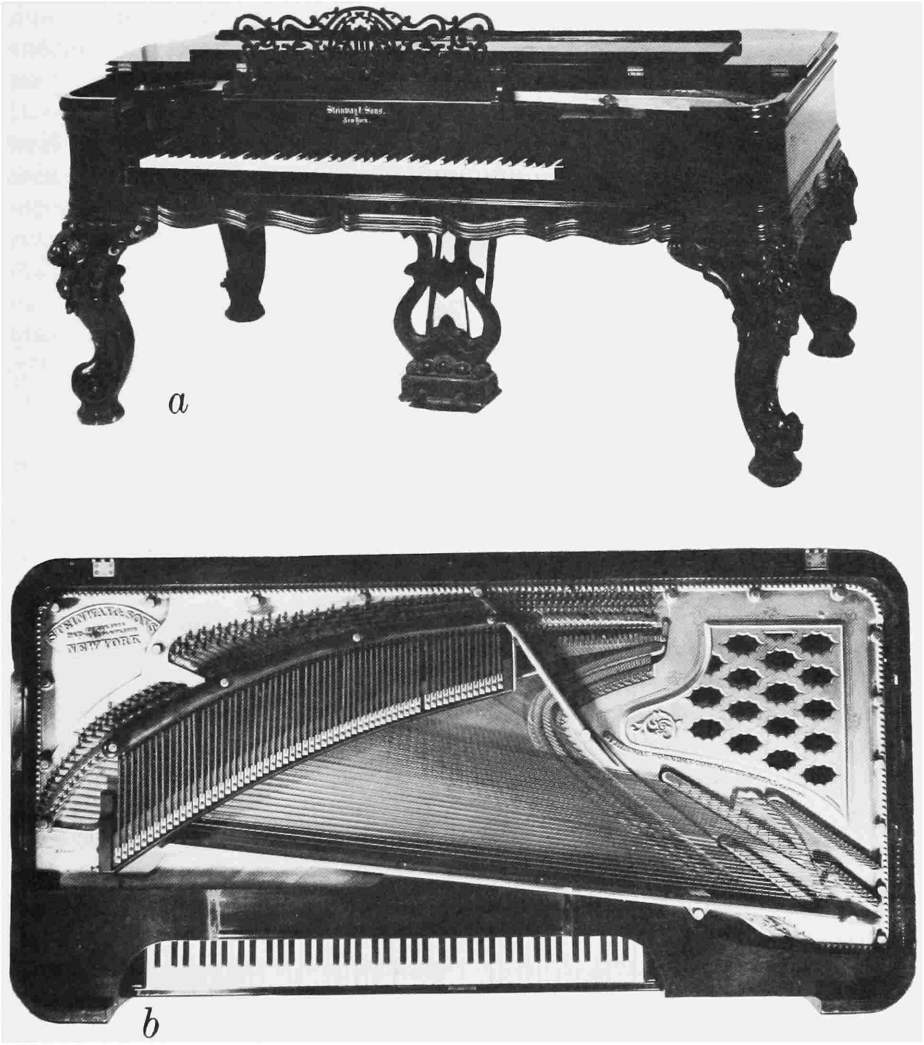


FIGURE 19. Square piano by Steinway & Sons, New York, 1877. Compass AAA to c^5. *a*, Full view. Two pedals: damper and *una corda*. *b*, Plan view showing cross-stringing and cast iron frame. (Catalog number 381,444; gift of George M. Harris.)

It remained for the Steinway firm a few years later to win, conclusively, "the battle of the iron frame," but it was none other than William Steinway who hailed Chickering as "the father of American pianoforte making."

The Steinways, father and three sons, appeared on the New York scene in 1849. Heinrich Engelhard Steinweg, in his native town of Seesen, Germany, had served as apprentice to an organ builder and had built a few pianos, including one made in his kitchen for his bride, before he deemed it expedient for political reasons, to leave his native land. Once in this country he lost no time in learning English and Americanizing his name to Henry Engelhard Steinway, and, along with his sons, finding employment with experienced piano makers until they were ready to establish their own firm in 1853.

The Steinway's rise to leadership in their trade was meteoric. Only two years after establishing their firm, their over-strung square piano with a full iron frame created a sensation at the fair of the American Institute in New York. They had achieved not only a sturdy piano, but also the finest tone up to that time. The iron frame and over-stringing plan, adapted for grand pianos a few years later, became the standard for all future models.

At the Paris Exposition of 1867 both Chickering and Steinway pianos received gold medals, an American victory of great significance. Figure 19*a* shows a square Steinway piano such as the prize-winning one of 1855, in which the bass strings run diagonally above the treble strings (Figure 19b). This over- or cross-stringing was adopted by a number of makers before the mid-nineteenth century. With this method of stringing full advantage of the available space is utilized, making it possible to install longer bass strings and to run them over the center and most resonant area of the soundboard to produce greater

sonority. In earlier instruments all the strings run parallel.

The square piano continued in use in this country long after the upright had supplanted it in modest homes in Europe. However, by the time that the last square was made by Steinway, in 1889, it was also being supplanted by uprights in most middle-class American musical families. Although limited primarily to the concert stage during a good part of the nineteenth century, grand models were being demanded by serious musicians and the affluent society before the century ended.

Among the advantages of the grand over the upright are the following: The floor under the horizontal soundboard of the grand acts as a sound-reflecting surface, whereas the upright normally stands close against a wall that is accoustically dead; the open lid of the grand directs the sound to the audience; the grand's hammers and dampers fall back into position by gravity, but in the upright they must be assisted by a spring mechanism that must be kept in adjustment; the shape of the grand is more attractive than that of the upright, and the performer seated before it is in a more agreeable relation to the audience than when seated at the upright model.

* * *

As makers have always been concerned with producing better pianos, pianists have been equally interested in improving their playing techniques. To the latter aim, one Paul von Janko applied his ingenuity.

Janko was a Hungarian inventor, educated in engineering and music in Vienna and Berlin. Concerned with the configuration of the pianist's hand in relation to the distribution of naturals and accidentals on the conventional keyboard (necessitating a multiplicity of fingering patterns), he presented to the public a new keyboard design, which could be installed in any piano (Figure

20). The design consisted of six ranks of keys, each tuned to the whole tone scale, the first, third, and fifth rows starting on C, the alternate rows on C♯. Thus, all diatonic scales could be played with only two sets of fingerings (no mean advantage), the multiple rows accommodated the unequal lengths of the fingers in playing chords, and the tuning system that reduced the octave span by 5½ centimeters permitted greater than normal stretches and widely spaced chords.

FIGURE 20. Upright piano by Decker Bros., New York, ca. 1890. Compass AAA to c^5, Janko keyboard. Two pedals: damper and *una corda*. (Catalog number 299,840; Hugo Worch Collection.)

Janko published a treatise on the use of the keyboard in 1886 and gave some recital demonstrations. By the 1890s, the Paul von Janko Conservatory of Music in New York had been established to teach this new method.

While there is no doubt that the Janko keyboard merited consideration, and a few makers manufactured pianos equipped with it, ingrained habits are difficult to overcome and pianists evidently found that it created new technical problems without really solving the old ones. The keyboard was abandoned around the turn of the century.

The "White House" Steinway

In 1903 (the fiftieth anniversary of the founding of the firm) Steinway & Sons made their one hundred thousandth piano, a concert grand. They proudly presented it to the White House in observance of the anniversary and, also, in gratitude to the country in which they had achieved such a stunning success. The gesture was "a paean of thanksgiving by a family who arrived on these friendly shores from abroad and here were permitted to make their homes and their lives, and to pursue their work with happiness and contentment."

Steinway & Sons was by now a great name in the world of music. The finest pianists the world over were playing their instruments, often to the exclusion of others, and their grand piano, a superb musical instrument, had attained its present form.

The "White House" piano of 1903 incorporated the metallic action frame patented in 1869, the repetition action, the capo d'astro (capo tasto) bar of 1875, the duplex scale of 1872, and the sostenuto pedal of 1874.

Repetition action was first introduced in 1821 by the French

maker Erard. Also known as "double escapement," it is a refinement that permits the hammer, while the key is down, to remain arrested on the rebound at an intermediate point close to the strings instead of dropping back to its original resting place. This results in a more responsive and sensitive action making more subtle nuances possible and greatly facilitates the rapid repetition of a note. In some measure it achieves the touch-sensitive quality of the Viennese action without sacrificing the power of the English action.

The capo d'astro bar along with the agraffe and harmonic bar reinforce the pressure of the bridge on the soundboard to ensure maximum communication between the two and also to prevent the hammers from knocking the strings out of position on the bridge.

The duplex scale is a method of stringing that takes advantage of the normally unused portions of the strings in front of the agraffe and beyond the back hitchpin of the bridge by proportioning these lengths so that they vibrate in sympathy with the speaking lengths of the strings to enrich the tone.

The sostenuto or middle pedal, although originally a French innovation, has seldom been applied to European pianos. The Steinways perfected their own version of it in 1874. It makes possible the sustaining of a note or group of notes by keeping their dampers raised while the other dampers are controlled as usual by the damper pedal. Actually it is awkward to use and ignored by most pianists.

The case of the "White House" piano as seen in Figure 21 was designed by R. D. and J. H. Hunt. It is covered with gold leaf and decorated with romantic paintings by Thomas Dewing and the seals of the original thirteen states.

It graced state occasions at the White House until it was replaced by the three-hundred thousandth Steinway in 1938, an

FIGURE 21. Concert grand piano by Steinway & Sons, New York, 1903. Compass AAA to c^5. Three pedals: damper, *sostenuto, una corda.* (Catalog number 379,287; transferred from the White House.)

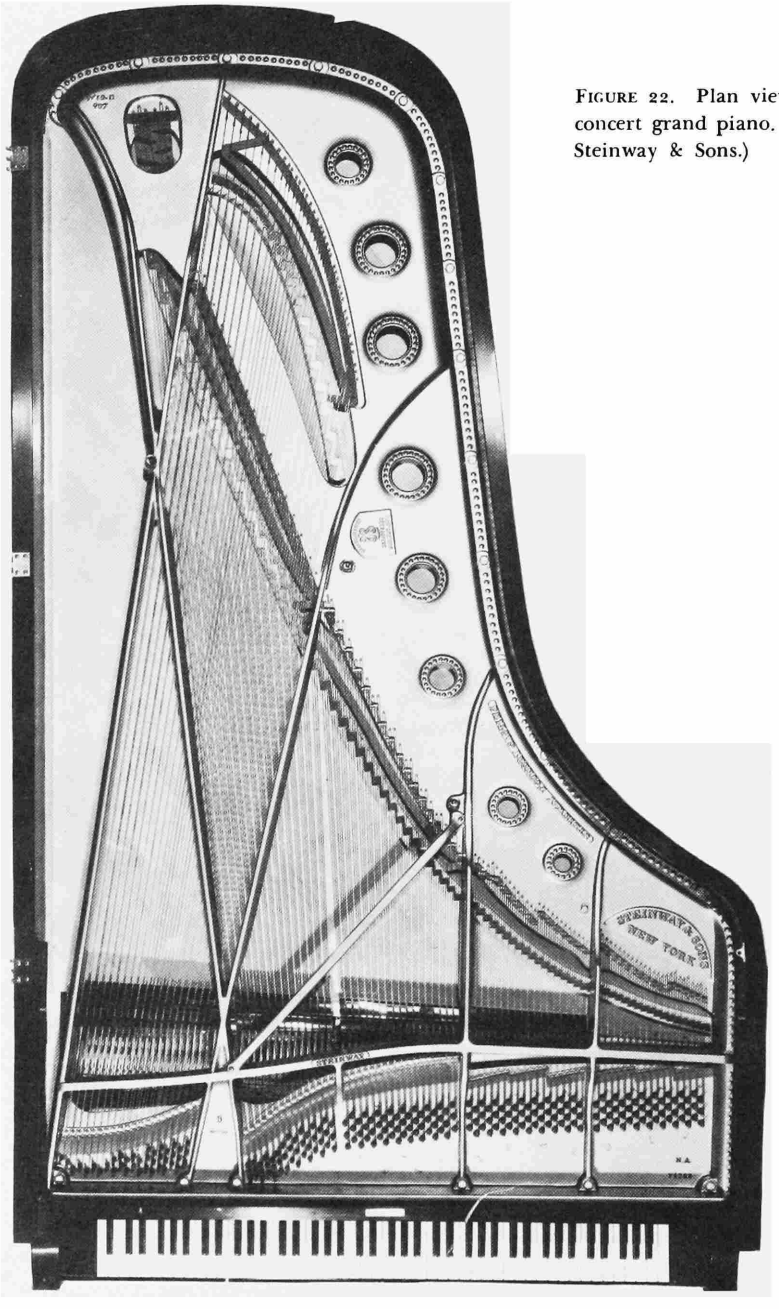


FIGURE 22. Plan view of modern concert grand piano. (Courtesy of Steinway & Sons.)

equally sumptous concert grand, again a gift of the firm that made it. At this time the first one was transferred to the Smithsonian Institution. The Steinway firm continues to be operated by members of the founding family and to maintain the standards of excellence established from the beginning.

Figures 22 and 23 show details of a modern concert grand. The latter illustrates the complex feat of engineering that has been accomplished and also explains much of the terminology that has been used here. It is a far cry from Cristofori's piano of some 275 years ago and yet it must be emphasized again that the basic principles of operation are the same.

Today's piano contains some 12,000 individual parts. The cast-iron frame of the nine-foot concert model withstands a tension of nearly twenty tons. The diameters of the strings vary from about one-third of an inch for the lowest (this measurement includes the copper overspinning around the steel core) to one-thirtieth of an inch for the highest strings. The copper overspinning is a space-saving measure to lengthen the bass strings in correct proportion to the treble strings without necessitating a grotesquely long instrument. The bottom eight strings are single and copper-spun; there is a pair of steel strings for each of the next twelve notes and three each for all the rest.

One would be tempted to conclude that the climax of the history of the piano has been reached but for the fact that fine piano makers, as with all great musical instrument makers, are forever striving for the "ideal." So the story is not ended and research and experimentation continue, always with the aim of producing a still finer tone, a still more sensitive and responsive action, and still greater stability. This brief account has indicated some of the steps along the way.

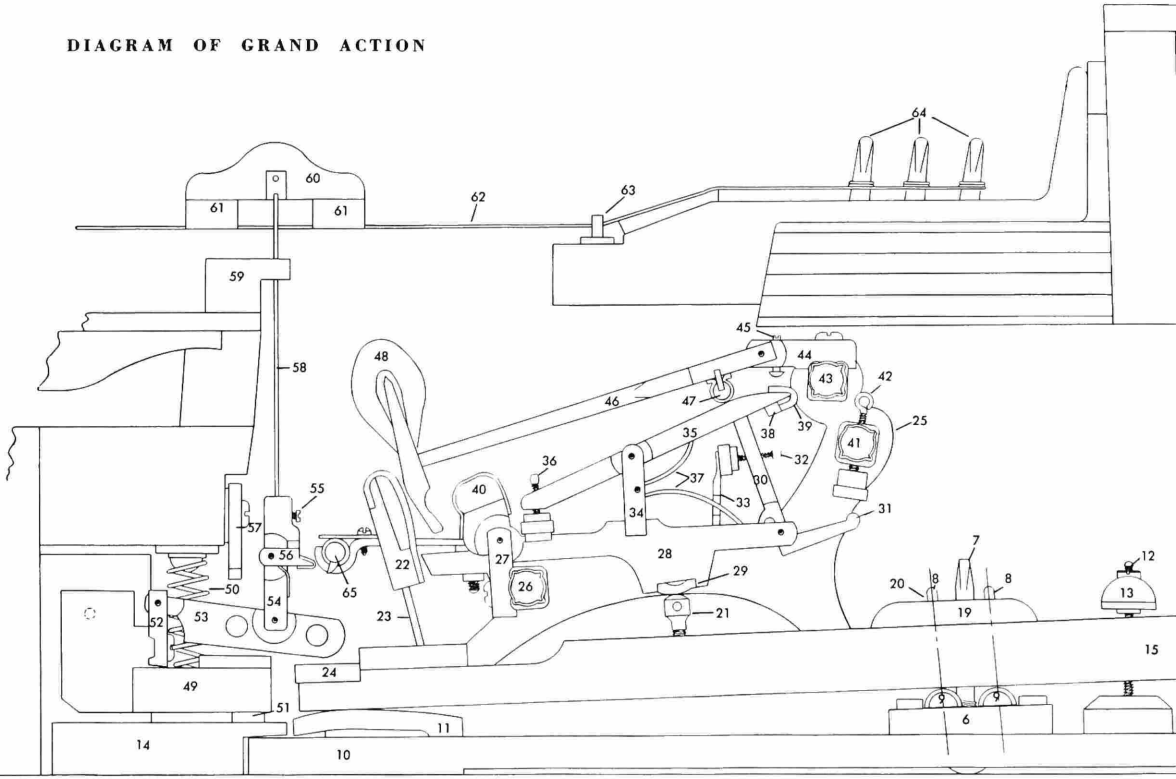
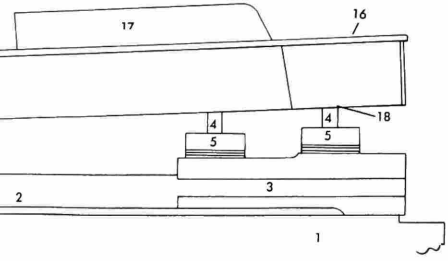


FIGURE 23. Action of a modern grand piano.
(Courtesy of Steinway & Sons.)

1 Keybed
2 Keyframe
3 Front Rail
4 Front Rail Pin
5 Front Rail Pin Punching
6 Balance Rail
7 Balance Rail Stud
8 Balance Rail Pin
9 Balance Rail Bearing
10 Back Rail
11 Back Rail Cloth
12 Key Stop Rail Prop
13 Key Stop Rail
14 Dag
15 Key
16 Key Covering
17 Sharp
18 Front Pin Bushing
19 Key Button
20 Balance Pin Bushing
21 Capstan Screw
22 Backcheck
23 Backcheck Wire
24 Underlever Key Cushion
25 Action Hanger
26 Support Rail
27 Support Flange
28 Support
29 Support Cushion
30 Fly
31 Tender
32 Fly Regulating Screw
33 Spoon
34 Support Top Flange
35 Balancier
36 Balancier Regulating Screw
37 Repetition Spring
38 Repetition Felt
39 Balancier Covering
40 Hammer Rest
41 Regulating Rail
42 Letoff Regulating Screw
43 Hammer Rail
44 Hammershank Flange
45 Drop Screw
46 Hammershank
47 Knuckle
48 Hammer
49 Underlever Frame
50 Underlever Frame Spring
51 Underlever Frame Cushion
52 Underlever Flange
53 Underlever
54 Underlever Top Flange
55 Damper Wire Screw
56 Tab
57 Damper Stop Rail
58 Damper Wire
59 Damper Guide Rail
60 Damper Head
61 Damper Felts
62 String
63 Agraffe
64 Tuning Pin
65 Sostenuto Rod



Selected Bibliography

Apel, Willi, editor. *Harvard Dictionary of Music.* Cambridge, Massachusetts: Harvard University Press, 1962. [See "Pianoforte."]

Brinsmead, Edgar. *The History of the Pianoforte with an Account of Ancient Music and Musical Instruments.* London, Paris, and New York: Cassell, Petter and Galpin, 1877.

Closson, Ernest. *History of the Piano.* Translated by Delano Ames. London: Paul Elek, 1947.

Clutton, Cecil. "The Pianoforte." Chapter 5 in *Musical Instruments through the Ages.* Edited by Anthony Bains. Baltimore: Pelican Books, 1969.

Dolge, Alfred. *Pianos and Their Makers.* Covina, California: Covina Publishing Company, 1911.

Fabbri, Mario. "Il primo 'pianoforte di Bartolomeo Cristofori'." *Chigiana Rassegna Annuale di Studi Musicologici* (Florence), new series I, volume 21 (1964).

Harding, Rosamond. *The Pianoforte—Its History Traced to the Great Exhibition of 1851.* Cambridge, England: Cambridge University Press, 1933. [Reprinted, New York: DeCapo Press, 1973.]

Hipkins, A. J. *A Descriptive History of the Pianoforte.* London: Novello Ewer and Co., 1896.

————. "Pianoforte." In *Grove's Dictionary of Music and Musicians.* 3rd edition. New York: The MacMillan Company, 1941. [See also 5th edition, New York: St. Martin's Press, Inc., 1959.]

Hipkins, A. J., and K. Schlesinger. "Pianoforte." *Encyclopaedia Britannica.* 11th edition. Cambridge, England: Cambridge University Press, 1910.

Hirt, Franz Joseph. *Meisterwerke des Klavierbaus.* Olten, Switzerland: Ims Graf-Verlag, 1955.

James, Philip. *Early Keyboard Instruments.* New York: Frederick A. Stokes Co., 1930.

Jung, Karl, and Hubert Unverricht. "Klavier." In *Die Musik in Geschichte und Gegenwart.* Edited by Friederich Blume. Kassel, Germany: Bärenreiter, 1958.

Juramie, Ghislaine. *Histoire du Piano.* Paris: Prisina, 1947.

Krehbiel, Henry Edward. *The Pianoforte and Its Music.* New York: Charles Scribner's Sons, 1911.

Loesser, Arthur. *Men, Women and Pianos.* New York: Simon & Schuster, 1954.

Marcuse, Sibyl. *Musical Instruments: A Comprehensive Dictionary*. Garden City, New York: Doubleday & Company, Inc., 1964. [See "Piano."]

Michel, N. E. *Michel's Piano Atlas*. Rico Rivera, California: N. E. Michel, 1961.

Rimbault, Edward F. *The Pianoforte*. London: Robert Cocks and Co., 1860.

Ripin, Edwin M. "Piano, Pianoforte." *Harvard Dictionary of Music*. 2nd edition. Edited by Willi Apel. Cambridge, Massachusetts: Harvard University Press, 1969.

Sachs, Curt. *Das Klavier*. Berlin: J. Bard, 1923.

Scholes, Percy A. *The Oxford Companion to Music*. London: Oxford University Press, 1938. [See "Pianoforte."]

Spillane, Daniel. *History of the American Pianoforte*. New York: D. Spillane, 1890.

Sumner, W. L. *The Pianoforte*. London: MacDonald and Co., Ltd., 1966.

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