

Seeking the Perfect Piano Piece, in Spruce

The big, curved rim of Steinway piano No. K0862 had been parked since early March in a hot, dark room, aging so it would never pop out of shape. Soon it would emerge, and workers would start putting things inside, from tiny hammers that strike the strings to the 340-pound cast-iron plate that anchors them. First, though, early in May, Paul Verasammy had to glue together 15 or so strips of spruce to make one of the components that will leave listeners either applauding No. K0862 as a great instrument or wondering why the pianist is having a bad night. He was working on the sounding board.

Once it has been fitted into place beneath the piano's strings, it will look like a five-by-nine-foot slab made of planks and rounded off at one end. It will be the piano's amplification system, a triumph of physics that can transform the weak vibrations from the strings into sound powerful enough to fill a concert hall. This hunk of glued-together wood will give No. K0862 its recognizable tonal signature. The sounding board, more than any other of the 12,000 parts that make up a Steinway concert grand, will largely determine whether No. K0862 is big and gutsy for Rachmaninoff or Tchaikovsky or warm and mellow for Mozart or Beethoven.

All Steinways are made the same way by the same people in the same factory, yet each is different. The reasons for this are a mystery, but the workers, each playing a different role, are certainly at the heart of the answer.

Take Jagdesh Sukhu, one of the woodworkers who pick boards from a stack of wood that spent the winter in Steinway's lumberyard. Mr. Sukhu has 14 years of experience in deciding what is right for a sounding board and what is not. On the day he was choosing wood for the sounding board for No. K0862, he rejected more than half of the wood in the stack for blemishes, knots, wormholes and other imperfections almost too small to see. (Never mind that spruce costs about \$7 a running foot.)

"How much we reject depends on the bundle," Mr. Sukhu said as he marked the rejects with a blue crayon. "Sometimes we reject three-quarters, sometimes one-quarter, sometimes more than three-quarters. When you do it every day, you know exactly what you want and what you don't want."

After so many years, his eyes can see flaws that ordinary eyes cannot. But he claims no special connection to wood, no special talent that makes him better at this than someone else. "They showed us a finished soundboard, what they accept, what they don't accept," he said, explaining how he learned the job. "I took over from there."

That's the way it has been for 150 years at Steinway. That unchanging process is one reason that Steinway's factory, once a showpiece of innovation, is now something of a time capsule for manufacturing methods that other industries left behind in the rush to automation — so much so that Steinway's manufacturing director, Andrew Horbachevsky, describes what goes on at the factory as "antimanufacturing."

Mr. Horbachevsky is in charge of an operation that is spread over five floors in a complex of gritty buildings that date from the 1870's. He says that New York City is probably the only place where a factory would exist in vertical form, where a 900-pound piano would work its way from the basement to the top floor and back down again before being completed. Anywhere but New York City, a 440,000-square-foot factory like Steinway's would be horizontal, a sprawling, single-story wonder. There would be no need to make appointments for the freight elevators to haul the pianos from floor to floor. There might be mechanical arms to lower the cast-iron plate into the rim, instead of the heavily muscled arms of workers cranking winches.

But Steinway does many things the way Steinway has long done things. It makes sounding boards according to designs it patented in the 19th century, in a factory that opened more

than 30 years before Henry Ford invented his assembly line.

Today the Steinway factory in Queens is a warren of interconnected structures, a universe of bare fluorescent lights hanging from the ceiling, of workrooms where a mouse occasionally darts across the floor, where the day is paced according to the company's union contract, of workers who sometimes spend their two 15-minute breaks napping on a cutting device the size of a Ping-Pong table or the shelves on which sounding boards are stacked.

The clock that matters is not the dusty one on the wall. (In the rim-bending department, the clock was an hour off all winter because nobody had bothered to reset it for Standard Time in the fall.) The clock that matters is the one that is unseen, the one that governs the factory whistle, now an electronic tone that signals the beginning or the end of a shift or a break. Once, the youngest workers at the factory were sent to a nearby bar on Friday afternoons to fetch buckets of beer. Though Fridays have been dry for years, other traditions remain. Some tools and machines are the very ones used by the fathers and grandfathers of workers using them today. As Joseph Gurrado, the rim-bending foreman, says when showing off the World War I-era photographs of the factory, "The only thing you'd have to change is the clothing on those guys."

Decades Defying Change

Steinway makes about 3,000 pianos a year, about the same number it made in the 1950's, and in many ways, the factory looks about the same as it does in pictures from that time. Or as it did in the 1920's, a golden age of piano-making. Or as it did at the end of the 19th century, when barges loaded with raw lumber docked at the edge of Steinway's 11-acre compound and the company operated its own foundry to make the cast-iron plates it had patented. Steinway officials say the company shut down the foundry in the 1940's, a move that made Steinway dependent on an outside supplier in a way it had never been. But Steinway continued its assembly operations in red-brick buildings that date to the 1870's.

"I hate to use the word 'walk back in time,' because it's more than that," said Bruce A. Stevens, the president of Steinway & Sons. "Most people don't believe the things that we do and how they're crafted in today's world. There isn't anywhere in the world that does what we do."

What goes on day after day at Steinway borders on being custom work. Competitors like Yamaha use more machines in mass-producing pianos (though Yamaha says it takes as long as Steinway does to turn out a grand the size of No. K0862, about nine months). And Kawai recently introduced a concert grand that costs more than \$150,000 — or nearly \$60,000 more than the price of a comparable Steinway — with plastic parts in places where Steinway uses wood. It is assembled by hand by a team of 12 people Kawai calls "master piano artisans."

"The impression one gets when confronted with the word 'handmade' is the visual impression of a craftsman with a saw, a hammer, a chisel and some nails building a piano," said Brian Chung, the senior vice president of Kawai America, "when in reality, all pianos, whether they're characterized as handmade or not, are made by people and machines. What differentiates one piano from another is the skill of the person. To say something's handmade does not describe the skill of the person. I could say something is handmade by a kindergartner."

Some pianists and piano technicians maintain that Steinway's quality is not what it once was — some say it slipped after World War II, others say during the 1970's and 1980's, when Steinway was owned by CBS. Steinway officials vehemently disagree and say their workers can match the craftsmanship of any in the world. Steinway officials also say that their labor-intensive approach makes each step in the manufacturing process responsive to every other step, something that would not be possible if machines did more of the work.

"There is a limit to automation," said Mr. Horbachevsky, the manufacturing director. "That will erode this product."

But there are moments when someone watching the process has to wonder if machines would not do some jobs better. Back in March, just after the rim of No. K0862 had been pulled off the press where it had spent its first 24 hours, its serial number was supposed to be hammered in. Eric Lall, the worker who did the hammering, pounded in the number his foreman had given him: K0863. The wrong number. Someone noticed, and soon Mr. Lall was hammering in a second number. The right number.

Lumber Stacked High

Antimanufacturing, as Mr. Horbachevsky calls it, means that Steinway largely shuns the efficient "just-in-time" production system that has been widely copied in American factories in the last 20 years. Besides giving Japanese automobile companies high-quality results and low production costs, just-in-time production saved them from keeping large inventories of parts and raw materials on hand to tie up money and space. By contrast, Steinway's lumberyard is a temporary home to millions of dollars' worth of wood — birch, maple, spruce, poplar. Some of it is earmarked for sounding boards, some for lids, some for wrestplanks, the thick chunks of laminated wood that are also known as pin blocks (a pin block holds the pins that tuners twist to bring a note up to its pitch, or take it down).

Steinway continues to keep its new wood in tall stacks — some in a hangarlike building, some in the open air. There is enough wood on hand to keep the factory going for six or seven months, even though Steinway does not expect to use all the wood that comes in. As Mr. Horbachevsky said, "We buy a high grade of lumber to start with, and still there are defects."

But if Steinway has not embraced production methods that have benefited higher-volume manufacturers, it has been willing to depart from the prevailing ways of the woodworking industry. In 1989, it changed the way some of its workers had been paid since the day the factory opened. It stopped paying them for how many pieces — legs, lids, sounding boards — they finished during a seven-hour shift.

"There was an incentive to rush through this, human nature being what it is, and it got us through 140-some-odd years that way," Mr. Horbachevsky said. "But this is not about speed necessarily. We're dealing with wood. If you rush things through, things are going to end up with wood twisting and warping in 60 days, and then you're going to say: 'Why did we do that?' "

It is a question that a foreman would have put to a worker after rejecting an imperfect piece — and, under the old system, ordering the worker to redo it on his own time. Steinway's 425 manufacturing workers are now paid hourly wages that average \$15.50.

`This Controlling Nature'

Steinway also differs from many companies in that the how-to manual for its products long existed only in the minds of workers who had been on the job for 20 or 30 years, and had learned what they knew from workers who had been on the job for 20 or 30 years before that. There was no single source that would explain how to do everything that had to be done to make a Steinway. The factory bosses did not keep comprehensive patterns or recipe-style instructions. Each worker learned the job by watching the person who had done it before. Some company officials say the idea was to prevent any one worker from knowing enough to leave the company and become a competitor.

That may have been important before World War I, when New York was a piano boomtown. In recent years, though, Steinway has begun documenting what its workers do and how they do it. This is a necessity in an era when hardly anyone spends an entire career with a single company; workers cannot be expected to learn their jobs the way their predecessors

did. Steinway officials say the mix of newer workers alongside experienced ones has not affected its standards, in part because many of the newcomers arrived straight from college, where they studied wood technology.

Another manufacturing trend that Steinway shunned is subcontracting — hiring outside suppliers to do work that had been done in the factory. Steinway, in fact, has gone the other way, buying the subcontractor that made the cast-iron plates. (It also makes plates for other piano companies.) "We've got this controlling nature," Mr. Horbachevsky said.

His definition of antimanufacturing also includes the idea that newer is not always better. Take the lacquers Steinway uses on rims, lids, legs and keyboard covers. The coatings Steinway uses were developed in the 1970's, said Robert Bernhardt, a Steinway manufacturing engineer. Newer coatings are more toxic, he said, and Steinway has not switched to them because the older ones are safer. In terms of appearance, it's a toss-up, Mr. Bernhardt and Mr. Horbachevsky say: the new coatings do not make pianos look better than the older ones.

An Important Match

Even though Mr. Sukhu rejected board after board, there was still enough wood left to go ahead with the next step in making the sounding board for No. K0862, lamination. The wood that Mr. Sukhu chose will go into No. K0862 and a handful of other concert grands. Which sounding board goes into No. K0862 will be determined almost at random, when a worker on a different floor picks one from a rack of seemingly identical pieces — whatever happens to be on hand the moment a sounding board is needed.

That marriage of rim and sounding board is a crucial moment in defining what No. K0862 will become. The randomness of it only deepens the question of how good No. K0862 will turn out to be. The moment when it can finally be played, and listened to, is still months away. For now, what counts is what can be seen.

Mr. Sukhu and the other workers in his part of the factory have grain counters — clear-plastic rulers they can use to measure whatever comes before them. The standard is straightforward: If there are fewer than 10 grain lines to an inch, the wood is not good enough for a Steinway concert grand. The fewer the lines, the faster a tree grew in the forest, and Steinway does not want wood from trees that grew too fast, because it is weaker. Nor does Steinway want trees that had many branches, because branches cause knotholes. Wood that is even, Mr. Horbachevsky said, helps the piano's sound. And beauty is a factor. "We want it to look uniform," Mr. Horbachevsky said. "You're paying 90 grand, you don't want a zebra stripe."

Mystery at Steinway | Uniform production methods, but unique instruments

What accounts for a particular piano's 'personality'?

It is a mystery. The same workers at the Steinway Sons factory bend and shape the wood the same way. The sounding boards are designed to the same specifications. Strings and pins, hammers and keys - there should not be noticeable variations. Yet every Steinway has a unique sound. Some are modest, some monumental. And no one is quite sure why.

This is the story of the making of one Steinway piano, a concert grand, No. K0862, at Steinway's plant in the Astoria section of Queens, where pianos have been made since the 1870s: The contest was between a giant sandwich of wood - 18 strips of maple, each about half as long as a city bus - and half a dozen workers with muscles, a pneumatic wrench and a time-conscious foreman. The workers were supposed to bend and shove those 18 strips into a familiar-looking shape, and beat the clock. "We're allotted 20 minutes," the foreman, Joseph Gurrado, muttered. After 14 minutes of pushing and pulling and flexing and grunting that another boss standing nearby called "the Fred Flintstone part of the operation," the

wood was forced into a curve.

And in the too-warm basement of a gritty factory that opened when Ulysses S. Grant was president, piano No. K0862 was born. Like other newborns, it came with hopes for greatness and fears that it might not measure up despite a distinguished family name. Or that it would be grumbled about by Steinway's customers - temperamental, obsessive, finicky pianists whose love-hate relationship with the company and its products is as complicated and emotional as anything in Chekhov. Steinway knows all this. Like No. K0862, every new piano that rolls out of the Steinway Sons factory is an attempt to refute the notion that the only good Steinway is an old Steinway.

So how good will No. K0862 be? Will it sound like "a squadron of dive bombers," as the pianist Gary Graffman said of a Steinway he hated on first hearing but came to love? Or will it begin life with the enormous bass and sweet-singing treble that pianists prize? No one can say. Yet. It will take about eight months to finish No. K0862, an 8-foot 11³/₄-inch (2.74-meter) concert grand. Along the way, the rim will be aged in a room as dim as a wine cellar. It will be sprayed with lacquer, rubbed and sprayed again. Its 340-pound (155-kilogram) iron plate will be lowered in and lifted out 10 or 12 times. It will spend time in rooms where workers wear oxygen masks to avoid getting headaches from smelly glues. It will be broken in by a machine that plays scales without complaint, unlike a student. Every Steinway is made the same way from the same materials by the same workers. Yet every Steinway ends up being different from every other - not in appearance, perhaps, but in ways that are not easily put into words: coloration of sound, nuance of strength or delicacy, what some pianists call personality. Some end up sounding small or mellow, fine for chamber music. Some are so percussive that a full-strength orchestra cannot drown them out. On some, the keys move with little effort. On others, the pianist's hands and arms get a workout.

Why? No one can really say. Perhaps it is the wood. No matter how carefully Steinway selects or prepares each batch, some trees get more sunlight than others in the forest, and some get more water. Perhaps, in a plant where everyone is an expert craftsman, some are great and others are merely good. No. K0862 will be pounded and caressed in the factory by woodworkers with tattoos on their burly arms, by technicians known as bellymen, by tuners confident that they can improve it, no matter how good it sounds at first. There is Anthony Biondi, 31, who was hired nine years ago as a veneer cutter, someone who selects wood for rims. His tools include the oldest machine still used in the factory, a 130-year-old cutter, and the newest, a million-dollar trimmer that arrived in January. There is his boss, Gurrado, the foreman. When Steinway hired him in 2000, he had no experience in woodworking but 15 years in manufacturing. And there is Andrew Horbachevsky, 44, the manufacturing director who has worked for Steinway for 15 years. "This company kind of sucks you in," he said. "I've had a dream where my wife turned into a piano". No. K0862 will have what Steinway calls an ebonized finish, meaning it will be painted black. Steinway says the finish has no effect on the sound. But the guts of every concert grand - the strings, the hammers that strike them, the keys to which the hammers are attached - are identical.

Even in the 1920s, a golden age, there were probably pianists and tuners who whined that the best pianos were those made at the end of the 19th century. There are certainly pianists today with a fondness if not a reverence for Steinways from the 1920s and 1930s. "The brand-new Steinways tend to be a little blank," said the pianist Erika Nickrenz. "They have all the characteristics, but it takes pianists to play them and really bring out what's there." But in a tryout at Steinway's showroom in Manhattan, she preferred a grand that left the factory on April 27 to four others, including one from 1962. "Older is not better, and we can prove it," said Bruce Stevens, the company's president. "Where that started was with people who make their living rebuilding Steinways, and they tell their customers that. We've just about given up rebutting it."

The eight-month manufacturing schedule for No. K0862 does not include the morning Biondi spent slicing the stack of wood for the rim into pieces 3/16 of an inch (4.8 millimetres) thick and roughly 8 feet (2.4 meters) long. Nor the time he spent taping those pieces into 22-

foot-long strips to form the "book," as the sandwich of wood that becomes a rim is known at the factory. Among Steinway's workers, Horbachevsky says, rim-bending was once dominated by Italians. No one can say for sure why they were hired for those jobs more often than for others, but when a job was available, someone at Steinway would tell a friend, who would apply. In the 1980s, Caribbean immigrants began taking the place of Italians who retired. Now the crew includes three Bosnians.

On the way to what Steinway calls the rim-bending machine - essentially a piano-shaped vise - Gurrado's crew made an important stop. Workers fed the book layer by layer through a glue-spreader that looks something like a washer with a wringer. At the far end, two workers, Tommy Stavrianos and Jean Robert Laguerre, dipped brushes in glue pots for touch-ups. The rim-benders use their physical strength in a way that is unusual in a modern factory. At 9:54 a.m., the crew leader, Eric Lall, is busy shoving the sandwich of wood into place along the side of the piano where the keys for the bass notes will be. He begins tightening spindles on the clamps while Patrick Acosta, 30, uses a long-handled lever to force the rest of the book toward the big curve at the end. At 10:10, with a whack from Acosta, the rim is done. "Fourteen minutes," Gurrado says. The time allotted for bending a rim is 20 to 25 minutes. As Gurrado explains, "We're working against the glue." It begins to set as fast as that. The rim spends its first 24 hours clamped in place. "Wood has a memory," Gurrado says. The day in the clamps is deprogramming time, so the wood will forget its past and not pop out of its new shape. After three days across the workroom from where it was bent, it goes to a room that looks like a wine cellar but is warm and dry and on an upper floor in the factory. It will spend about 60 days there. "It's going to be whatever it's going to be, good or whatever," Stavrianos says. "There's nothing you can do now but wait. It's out of our hands."

Steinway Factory, New York, NY



In a unique method used by Steinway for over a century, the inner and outer piano rims are bent into the shape of the rim as a single continuous piece. Before Theodore Steinway developed and patented this method in 1878, rims were made of separate pieces held together with joints. 18 hard-rock maple layers, each twenty-two feet long, are used to construct the rim of a concert grand piano. The layers are first coated with glue and stacked. The stacked layers are then glued into a single form of wood by bending on the rim-bending press, a giant piano-shaped vise. The rim-bending team centers the layers on the press and wrestles the wood into place with the aid of clamps.



The soundboard is a large wooden diaphragm with a wooden bridge centered on its top side. The piano strings pass over the bridge, and the bridge transfers the string energy into the soundboard. As a result, the sound of the strings is amplified. The soundboard is pressed into the shape of a dome, allowing it to withstand the combined downward force of 1,000 pounds from over 200 strings.



The Steinway soundboard is carefully formed, by hand, into a patented Steinway design. Close grained quarter-sawn spruce is used to make the soundboard because the wood is flexible enough to vibrate and therefore project sound, but strong enough to support the weight of the piano's strings. The soundboard is expertly tapered by a craftsman to be slightly thinner at the edges so that it can vibrate properly once it is glued to the piano's inner rim.



Before a soundboard can be placed into a piano case, the bridge must be notched for the strings that will pass over it. First, a heavy black graphite is applied to the top of the bridge. A three-pronged tool is then used to mark the points where the bridge will be pinned and notched. It takes years of training for the craftsman to know exactly where to place the notches. To ensure cosmetic beauty for a wood-finished instrument, all of the veneer on a single Steinway piano is cut from the same tree. In the veneer room of the factory, veneer is cut to size, matched and identified with the piano number.



The piano rim is being transformed into a piano case. A wooden brace assembly is being custom fit within a rim structure. This network of bracing helps support the 340 pound cast iron plate. The braces fan out within the rim structure for stability and are secured into the rim by using a combination of fine joinery and maple dowels.



The arms of the piano are sanded into shape.



Here, a cast iron plate is being fit into a piano case. The 340 pound cast iron plate provides a rigid and stable foundation needed to hold approximately 40,000 pounds of string tension. Graphite has been spread over the portions of the cast iron plate that come into contact with the rim and pin-block. The plate is then lowered into the piano case, fitted, and then raised out of the case. The rim and pin-block surfaces that show print from the graphite indicate an improper fit with the plate and are shaved to eliminate gaps between the two surfaces.



Once the soundboard and cast iron plate are in the piano case, the piano is ready for its strings. With unerring aim, the stringer inserts a wire through the hole in a tuning-pin. A machine guided by the stringer turns the pin three times, wrapping three wire coils around it. The pin is then placed through one of the more than 200 holes in the cast iron plate and driven into the pin-block.



The action's felt hammers are made from a single strip of felt that is pressed into shape. To form the hammers, glue is first applied to the inside of the felt strip. The felt is then placed in a long, grooved copper form and pressed around a three-foot long wood rod into the pear shape of a hammer. Once the felt has been pressed and removed from the machine, the rod is sliced. Each piece becomes a hammer which is twirled onto a hammershank.



The wood of the hammershank is sometimes heated by a small flame to make subtle adjustments in placement. The dampers prevent the piano strings from unintentionally vibrating after the strings have been hit by the hammers. A master technician painstakingly matches the damper felts to the strings. The technician must then reach underneath the piano and, with mirrors, adjust the levers that control each of the dampers.



In a process called the action weigh-off, each key in the keyboard is calibrated to have a consistent feel. Weights are placed on the key and lead is inserted into the body of the key until the pressure needed to push the key down is the same for each key. The voicing process involves minute adjustments to the hammer, which are critical to the piano's sound and the distinctive personality of each Steinway.



A master voicer makes adjustments to the hammer's resiliency by sticking the hammer's felt with a small row of needles, reducing its stiffness and thereby mellowing its tone. If the voicer wants to increase the brilliance of the key, he will harden the felt by applying a small amount of lacquer. The voicer must approve of the tone quality of each key.



A tone regulator listens intently to the piano's pitch and turns the tuning pins with a tuning hammer to adjust string tension.



Once the piano has been regulated, it is ready for its final inspection.