Chapter 3

Maintenance

> *Get up from that piano. You hurtin' its feelings.*
> —Jelly Roll Morton

The care and maintenance of pianos is often misunderstood. A piano is treated as a piece of furniture and is exposed to wide ranges of humidity and temperature, but the owner expects it to function flawlessly for decades without *any* servicing other than tuning. The reality is that pianos don't tolerate climate changes well, and require periodic servicing whether or not they are played.

Figure 195 *Heavy-duty padded piano cover.*

Environment

This may be the most important topic in this book: controlling the climate is an absolute prerequisite for a piano's stability and longevity. Humidity and temperature must be kept at acceptable levels and within close tolerances, or the instrument will go out of tune and deteriorate. The first rule is not to place a piano near sources of temperature and humidity changes: poorly insulated outer walls, windows, radiators, directly over or under heating or air-conditioning vents, or in direct sunlight, or a draft. The second rule is to maintain the temperature and humidity at levels as constant as possible. A piano subjected to unstable climate conditions will not hold its tuning, its soundboard will degrade, other wooden parts will crack, the finish will get damaged, and the action will become sluggish or loose.

The effects of climate changes can be reduced to some extent by keeping the lid of a grand piano closed, and the piano draped in a padded cover when not in use (Figure 195). The cover absorbs and releases moisture, evening out changes in humidity, and helps protect the finish.

Humidity

Humidity affects all materials in a piano. The dimensions of porous materials like wood, leather, and felt change with variations in humidity, while metals oxidize in excessive humidity. Wood swells and shrinks because its hollow cells absorb and release moisture from the air. Because of the composition of the cells, the swelling causes the wood to expand *across* the grain much more than along it. Consequently, when the grain in a wooden board runs at varying angles, which is almost always the case, the swelling causes *warpage* (see page 60). The best way to reduce warpage is to control humidity.

Relative vs. Absolute Humidity

Air retains a certain amount of moisture in the form of water vapor. The higher the temperature, the more moisture it can retain. The total amount of moisture retained in the air is expressed as *absolute humidity. Relative humidity*, on the other hand, is the ratio between the amount of moisture present in the air and the maximum amount of moisture that air could retain at that temperature. This ratio is expressed as a percentage. A relative humidity (R.H.) of 100%, for example, means that the air is fully saturated with water vapor; an R.H. of 50% means that the air can retain exactly twice as much as it already does, etc.

Because warm air can retain more moisture than cold air, the same absolute humidity results in different relative humidity readings at different temperatures. When the air is heated, its relative humidity drops because the absolute amount of moisture in it becomes small in comparison with the maximum amount it can retain at the higher temperature. This is what happens during the heating season—even when the relative humidity outside is high, the heating makes it drop precipitously inside (see Table 1). For example, when it is 30° F [–1° C] and 60% R.H. outside, the inside air heated to 72° F [22° C] will have only 13% R.H.—a disaster for the piano unless moisture is added.

Table 1: Relative Humidity (%) after Heating Outdoor Air to 72°F [22°C]

R.H. Outside	Outside temperature (°F [°C])						
	0 [–18]	10 [–12]	20 [–7]	30 [–1]	40 [4]	50 [10]	60 [16]
20%	1%	2%	3%	4%	6%	10%	13%
40%	2%	4%	6%	8%	12%	18%	22%
60%	3%	5%	8%	13%	19%	28%	32%
80%	5%	7%	11%	17%	25%	37%	47%
100%	6%	9%	14%	21%	31%	46%	53%

When the temperature drops far enough, the air can't retain all its moisture as vapor and the excess *condenses* into liquid. That is why a cold object "sweats" when brought into a hot, moist environment—the air immediately around it cools quickly, and a certain amount of moisture condenses on the object.

Soundboard and Tuning Stability

As wooden cells in a soundboard swell and shrink due to changes in relative humidity, the board wants to expand or shrink across the grain, but the ribs to which it is attached do not permit that. Since the soundboard is crowned upward to resist the *downbearing* of strings, its expansion and shrinkage affect the degree of crowning. Expansion increases the crowning, pushes the bridges up, increases their pressure against the strings, and makes the pitch rise (Figure 196). The opposite is true of shrinking—it reduces the degree of crowning and lowers the pitch.

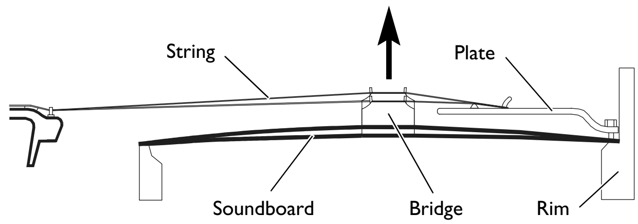

***Figure 196** An increase in soundboard crowning increases string tension.*

Since the greatest change in crowning occurs in the widest area of the soundboard, the greatest variations in pitch tend to occur in the tenor section. The middle section can be greatly affected as well. For example, a piano in which A4 is tuned to 440 Hz at 50% relative humidity may get above A450 at 90% R.H., while the deep bass and high treble remain close to A440. When the R.H. drops to 10%, the same piano may drop to under A430 in the middle. In some climates, relative humidity in a home without air-conditioning may exceed these extremes.

Finishing Materials and Protection from Vapor

Most modern finishing materials used in pianos are "waterproof," meaning they prevent water as liquid from seeping through and causing water marks or other damage. However, those same materials may be poor barriers to water *vapor*. That explains why lacquered brass hardware eventually tarnishes, and why soundboards and other finished wooden parts swell and shrink when subjected to changes in relative humidity.

None of the finishes seals the wood completely, but some, such as those based on polyester, epoxy, and polyurethane, have a high moisture-excluding effectiveness (MEE), and significantly slow the exchange of water vapor with the environment (see "Selecting a Finish" on page 469). Of these, polyester is the one most commonly used in pianos, especially those made in Europe and Asia. The slower the exchange of water vapor, the more stable the tuning. But although a high-tech finish will reduce the effects of daily and weekly climate swings, it won't protect a piano from the yearly cycles of expansion and contraction.

Ideal Humidity

The materials used in pianos perform best at different levels of relative humidity. **Wood**, for example, requires relatively high levels of R.H. because of its cellular structure—without water vapor, wood cells shrink, their walls become brittle, and wood cracks, especially in thin boards such as the soundboard. Excessive moisture, on the other hand, makes wood swell and, in boards that are not allowed to expand, creates enough internal compression to crush the wood cells. The ideal R.H. for woods used in pianos depends on the target moisture level for which the piano was made. Most pianos for the American and Euro-

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Infestations should be treated promptly by professionals. If you find damage but no evidence of active infestation, you can clean it yourself, but beware of the diseases spread by rodents (see “Rodents and Diseases” on page 136).

Preventing Corrosion

Humidity is not the only factor that promotes corrosion of metal parts. Woods, glues, and finishing materials in pianos release acidic gases that attack all metal parts, from strings to tuning pins, springs, action center pins, key pins, even key leads.[184] Corroded leads can expand so much that they split the keys and block the entire keyboard. Trying to depress the keys of such a keyboard results in further damage (Figure 203).

Photo by Allen Wright, RPT

Figure 203 *Damage to the backs of keys in an Érard vertical piano from ca. 1890, caused by corroded leads. Additional damage was caused by attempts to depress the keys, which had been immobilized by the expanded leads.*

The best way to avoid corrosion is to periodically air the piano. Keep the fallboard open at all times, or at least during the day. Whenever playing a grand, open its front lid; in a vertical, open the top lid from time to time.

Periodic Maintenance

Tuning

Pianos should be tuned twice a year or more often, depending on the amount of use and seasonal changes in climate. Stable pianos in a well-controlled climate may need to be tuned only once a year. Aside from the obvious benefits, tuning a piano regularly promotes pitch stability, allows servicing the piano humidifier/dehumidifier, and provides an opportunity to address any other problems.

Myth:	**This piano never needs tuning.**
Truth:	Usually you hear this statement when the piano is so out of tune that it seems to have stopped changing. In reality, a well-tuned piano may stay in tune up to a few years in an extremely stable climate, but eventually the pitch will drop (unevenly), due to the settling of the soundboard and the case.

Regulation

Like any fine mechanism, the piano action, keyboard, dampers, and pedals need to be regulated periodically. The **action** should be regulated every few years, preferably together with the keyboard. The regulation should include lubricating the parts, adjusting the pedals, and, in grands, adjusting the shifting of the key frame. A complete regulation and lubrication of the **keyboard** should be performed every four to eight years. The keys should be spaced, slanted keys corrected, and bushings eased as needed. If the key bushings are worn and key frame felts, including the punchings, are hard and noisy, they should be replaced at additional charge. All contact points should be lubricated. The **dampers**, especially in grands, need regulating less often, usually in conjunction with a rebuilding, or after replacing the damper felts, but their wires may need to be lubricated. **Pedals** should be regulated as needed, but should be inspected and linkages adjusted as part of every tuning. Low-quality pianos and those exposed to humidity changes may need to be regulated more frequently.

Cleaning and Polishing

Look for signs of rodent infestation. If you find any, decontaminate and clean the piano before proceeding (page 136), to avoid contracting a rodent-borne disease.

Cleaning Key Tops

Plastic tops can be cleaned with a soft cloth and a mild solution of dishwashing detergent and warm water, cloth fully wrung out. If the dirt is caked on, use rubbing (70%) alcohol unless the key tops were painted (you may encounter this on some old pianos—be careful). Some technicians report good results with Simple Green®. Degreasers like 409 may be too aggressive and may dull the surface.

Porous tops, including ivory and cow bone, can be cleaned with a product such as Cory Key-Brite™ or Yamaha keytop polishing paste. Some people recommend a whitening toothpaste, but there may be long-term effects from the toothpaste residue. You can use alcohol to clean caked-on dirt. Don’t use it regularly, though, because it will dry out the ivory and make it absorb even more dirt.

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184 See John Watson, *Artifacts in Use*, pp. 140–144. The causes of and solutions to lead corrosion are discussed in `http://www.navsea.navy.mil/nswc/carderock/pub/cnsm/lead/lead_01.aspx`.