

City Talk



TAKE NOTE OF DESIGN STRESSES AND STRAINS IN PIANOS

Engineers invented the harpsichord during the Renaissance by laying the harp into a sound box played by a keyboard. That instrument is

the predecessor to the grand piano, with its shape and method of playing being similar.

The limitation of the harpsichord is that it produces the same volume of sound irrespective of how hard or soft a key is pressed.

In the 18th century, engineers turned the plucking action of the harpsichord into a fast-hammering action by a very sophisticated mechanism for each individual key. Apart from producing sounds of different quality, the keys become touch sensitive, with the loudness of the sound proportional to the striking force.

This instrument was given the name pianoforte, which literally means soft and hard notes, and later simply called the piano.

Industrialization had facilitated the steel frames to be produced with the ability to withstand the tension of over 200 stretched strings of each piano.

The robust frame allows the strings to be stretched to a high tensile force to produce the necessary notes.

The modern piano has 88 keys, with strings of descending lengths to allow the full spectrum of notes to be played.

The lower frequency notes are produced by one or two heavily wound strings of long lengths, and the high frequency notes by three lighter strings of short lengths. The shorter strings have a lower sound volume as it has less mass, requiring an additional string wire to boost the sound volume.

As the keys are struck, the strings are hammered to produce a series of notes.

A damper at the hammering end of each string halts the vibration once the key is released. For certain musical pieces involving the continuation of some of the notes, pedals are equipped to assist this.

A piano usually has three pedals. The



Nuts and bolts

Edmund Leung

right is the sustain pedal that blocks the action of the dampers to allow prolonged vibrations. The middle, called the sostenuto pedal, blocks the damping of only the notes being played when the pedal is applied but allow the other notes to be damped as usual. The left is the soft pedal, which softens the sound.

An experienced pianist would be able to use these pedals judiciously to play selected notes of a musical piece and enhance the quality for a listener's enjoyment.

Although the steel frame is engineered like a piece of machinery, the quality and shape of the wood for the striking keys, the complicated lever mechanism to amplify the action of the key strikes, the hammer material, the dampers and more importantly the wooden sound board and the outer casing of the piano, including its thickness and grain, are selected to produce the desired sound volume and tone.

To achieve consistent and pleasing notes, all these materials and shapes have been developed and evolved over the last three centuries to become the modern piano.

We called the piano in its original form the grand piano. For smaller rooms, the upright piano was developed after re-arranging the action mechanism and the steel frame geometry. Though sound quality may be compromised with this configuration, it occupies much less floor space than a grand piano.

So next time when you are praising the pianist playing lovely music, please do not forget the efforts of the engineers and craftsmen who developed pianos behind the scenes.

Veteran engineer Edmund Leung Kwong-ho casts an expert eye over features and forces in modern life