FROM A GUITAR MAKER´S NOTES:
„A SHORT NOTE ON THE CONSTRUCTION OF 10-STRING GUITARS“

by Sebastian Stenzel

Anyone who ever started playing 10-string guitar has had to accept that in addition to mastering the actual creation of sound, there is a problem to solve that doesn't exist in this dimension on a 6-string guitar: the dampening of unwanted resonances. These resonances from the additional strings confront the luthier with a contradiction that is in my opinion the most salient point in the construction of 10-string guitars: if the guitar has too much sustain, the player will be busy dampening rather than playing the guitar. If there is too little sustain, the guitar will be very stiff, lacking capacity of modulation, and - while functioning well with chords - sound rather boring when monophonic lines are played. The challenge for the guitar maker is to find the best compromise between these two poles.

Among the hundreds of guitars that I have scrutinized during the last fifteen years, there have been a few 10-string guitars, and even fewer really good ten-strings. It is my habit to take measurements of all interesting guitars that come into my workshop, and by comparing the data of different 10-string guitars, I learnt that there is a common misunderstanding among guitar makers about the construction of 10-string guitars. Due to the very little energy available to create a guitar sound (compared e.g. to the violin, where the bow allows a continues input of energy) the guitar is constructed close to the limits of static stability. With 10-strings this situation is aggravated by adding four more strings, thereby increasing the string tension on this fragile structure by approximately 60%. This seems to frighten many luthiers, who strenghen their soundboard in what they think is an equal measure, assuming a directly proportional relationship of soundboard thickness and static stability. In reality, the moment of inertia relevant to the profile of a body depends on the thickness to the third power. Simply put, every tenth of a millimeter in thickness more or less changes the stiffness considerably. As a result of this misconception, many ten-strings have been build too much on the safe side. Determining the right point of balance between stiffness and ”give“ when making the soundboard is probably most important of the many factors that make up for the acoustical properties of a guitar. The sensitivity necessary to find this point is challenged just a little more than when building a ”normal“ guitar.

Other dangers are lurking if the soundboard is not strong enough to counteract the higher string tension. Although a high ”responsiveness“ of the guitarbody is generally desirable, it is an essential aspect of the art of lutherie to dampen the resonances of the body, and particularly of the soundboard, sufficiently. This is necessary not only to achieve an even amplification of all notes, but also to prevent problems occuring from overcoupling of the string. Overcoupling means that the soundboard and the string start to behave as one vibrating system rather than two coupled ones. In this case, overtones of the string, sometimes even of the fundamental, are considerably destorted, resulting in ugly sounding notes and a bad balance.

As regards the details of construction of a 10-string guitar, it is quite obvious that they should be generally the same as those used in six-string guitars: it adheres to the same acoustic principles, the tuning is similar, and so are the basic dimensions of the guitar body. Any compromises made in regard to the added bass notes should be considered carefully: even the largest guitar with the deepest eigenfrequencies possible won’t have resonances corresponding to these deep bass notes. In addition, lower resonances of the body might only lead to overcoupling in the bass and considerably weaker trebles.

An obviously unevitable difference in the construction of the body is the much longer bridge that is more prone to torsion than its shorter 6-string brother. The potential feedback into the string from this movement might not only lead to overcoupling, but also give rise to nonharmonic longitudinal waves that produce a similar distortion. Consequently, dimensions and material of the bridge should be objected to especially thorough deliberation.

When making a 10-string guitar, the path of the best compromise is indeed a tight-rope-walk: Technically, a ten-string guitar is not so different from a six-string as one is easily led to think, but it will accentuate any faults and weaknesses of the chosen construction.