What was Loar hearing?

Roger H. Siminoff
PO Box 2992 • Atascadero, CA 93423, USA
805.365.7111 • www.siminoff.net

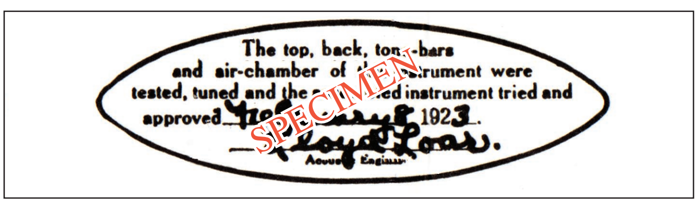
(Revised August 15, 2006)

Lloyd Allayre Loar (1886-1943) was a performing musician, composer, acoustical engineer, and musical instrument designer who made numerous major contributions to the world of music. He worked for the Gibson Mandolin-Guitar Company (Kalamazoo, MI) from 1920-1925. During his tenure at Gibson, he introduced the process of "tap tuning" to ensure that all parts of the instrument contributed to the whole of the sound. After leaving Gibson, Loar founded the ViviTone Company and, later, the Acousti-Lectric Company (both in Kalamazoo, MI). Loar received 11 U.S. patents. For more information about Loar, visit *www.siminoff.net*.

What was Loar hearing?

A poem entitled "Miniver Cheevy" by Edwin Arlington Robinson talks about a dreamer who always thought about what was and what could be. And, for others of us, we often think about times past, and compare what is now to what might have been. So, while we marvel at the magical sound of Loar-signed F5 mandolins, one might stop and think, "What was Loar hearing when he was building and playing these instruments? Did he hear the rich throaty sound that we admire in an F5 today? Or did he hear something else?"

Gibson's labels of the "Master Model" instruments that bore Loar's signature attest – and we've proven – that "The top, back, tone-bars, and air-chamber of this instrument were tested, tuned ..."



The "signature label" in Loar-signed Master Model Gibson instruments confirm the tuning process.

We know the instruments of Loar's day were new, not broken in, and absent of 80 years of aging characteristics we attribute to older instruments. We know the strings were a different composition than those we use today. We know that the plectrums of the period were made of a different type of plastic than we use today.

But there is something else that makes the original F5s unique, and it relates to precisely how they were tuned.

Tunings in the early 20th Century

In the 1920s, when Lloyd Loar was at Gibson designing instruments, he focused on tuning the various parts of the instrument to specific notes that were part of concert pitch. This "tuning" (or "tap tuning") is the art of building an instrument so that each of its tone-producing parts resonate in harmony with the notes being played on the strings. In this regard, the components of the instrument's body support, amplify, resonate with, and augment the frequencies being sent to the soundboard by the strings. This is what gives an instrument its "tone color" or "timbre."

Loar specified that the backboard of the F5 mandolins were to be tuned to *C*128, the treble tone bar to *A#*228, the bass bar to *Ab*203, and the air chamber to *D#*152.

Note:
"*C*128" represents a *C* note whose frequency is 128 cycles per second, more properly stated as 128Hz. *A#*228 represents an *A* sharp note whose frequency is 228 cycles per second or 228Hz. *Ab*203 represents an *A* flat whose frequency is 203 cycles per second or 203Hz, and *D*152 represents a *D* whose frequency is 152 cycles per second or 152Hz.

The idea of tuning each of the parts of the instrument wasn't fantasy or Gibson marketing hype. It is something the company really did during Loar's tenure from 1920 to 1925 (and then later, for a period of about a year with the introduction of the F5L in 1978). The process was time consuming and exacting, and one can only surmise that it led Gibson to discontinue the tuning process when Loar left the company in 1925.

While the art of tap tuning pre-dated Loar by several hundred years, the introduction of tap tuning to fretted instruments was clearly one of Loar's major contributions to both Gibson and to the world of fretted acoustic string instruments.

Does tap tuning work?

The results can be scientifically proven, and those of you who have followed my work know that I have performed tuning tests many times in many different ways. One simple experiment is to hang an F5 on an instrument stand and place a speaker on another stand facing, and close to, the mandolin. Then, subject the mandolin to a range of frequencies, via the speaker, from a sweep frequency oscillator (a device that produces a range of pure tones). As the various parts of the mandolin vibrate in sympathy with the tones from the speaker, they vibrate more responsively when their resonant frequency is attained. For example, if the air chamber is tuned to a *D#*, the mandolin howls when the speaker produces a *D#*. The responses can be measured by using a decibelometer and watching for the highest reading as you sweep through the frequencies. To determine the precise frequency of that loudest point, use a frequency counter and simply read the results on its panel.

Note:
A decibelometer is a device that measures sound pressure and provides a numerical value of the relative loudness of sound.

The next step is to determine which part is vibrating. In these tests, you can literally feel the backboard pulsing wildly as it vibrates in sympathy with the frequency oscillator. And you can feel the treble and bass tone bars individually vibrating in sympathy to their tuned notes merely by putting your fingers lightly on the soundboard. And, the air chamber howls as you arrive at its resonant frequency. These tests are very simple to perform, and the results are quite dramatic.

Variations of this test can be performed by placing fabric in one or both of the *f*-holes to modify the air chamber's tuning, attaching a special weighted clamp to one or both of the tone bars to dampen them, or using some method to isolate one component of the structure. These variations test how each component alters the way the instrument responds. The results of the tests clearly point to the fact that changing the tuning of the tone bars has a direct affect on the overall tonal characteristics of the instrument.

What did Loar do?
Loar saw to it that the instruments under his watch were carefully tuned. And, the results speak for themselves. Tuning works, and Loar-signed instruments really do sound great.

To test the tuning of the various components of the mandolin, a Hewlett Packard® Audio Oscillator is con-nected to a speaker and to a frequency counter. The large knob on the oscillator controls the sweep through a range of intervals from 20 to 200. The knob in the lower left corner controls the range intervals such that a setting of "1" equals 20Hz to 200Hz, "10X" equals 200Hz to 2,000Hz, "100X" equals 2,000Hz to 20,000Hz, and "1000X" equals 20,000Hz to 200,000Hz.


The F5 mandolin was placed on a music stand with the speaker facing it. As the oscillator sweeps through the frequency range, the instrument responds with "sympathetic vibrations" that can be sensed by touch or measured with the aid of a decibelometer.

But, let's not forget the question: What was Loar hearing?

It wasn't what we hear today!

Clearly, the instruments under his care were precisely tuned. But Loar didn't hear what we hear because in 1925 Loar was using *C*256 as the center point for his concert pitch. The scale that uses *C*256 is predicated on fourth octave *A* being 430.6Hz.

Today, our concert pitch is *A*440 (not *A*430.6).

When we play an original Loar-signed "tuned" F5 today, our strings are tuned to concert pitch which is predicated on *A*440, but the parts of the instrument are tuned to the concert pitch of Loar's time – *C*256 – in which *A* is *A*430.6. Basically, a quarter step or quarter tone lower. The difference is actually an average of about 9 to 10Hz, and that is just outside the threshold of unpleasant "beats." This chart compares the relative notes of the two tunings:

As a result, the soundboard, backboard, and air chamber of a Loar-signed F5 are tuned a quarter tone lower than our concert pitch of today. But, interestingly, this difference seems to add a pleasant "coloring" to the tone of the original F5s which, aside from being made 80 years ago, is one of the main attributes – if not THE main attribute – that sets their timbre apart from other mandolins. It is much like what experienced piano tuners do when they adjust one of the two or three strings of a particular note so that it is not quite in unison. Piano tuners call this "finessing," and it provides a unique warmth not achievable when tuning two or three strings of a given note in perfect unison.

Tuning new F5s to sound like Loar-signed F5s
Philosophically and scientifically, it is optimum to tune the various parts of an instrument to notes that are

part of the scale to which the strings are tuned. And, since instruments that are played in the United States today are typically tuned using *A*440 as the reference, then it holds that *A*440 should be the reference for tuning the instrument's parts.

However, in order to build a new instrument that delivers the timbre of an aged Loar-signed F5 mandolin (or L5 guitar, or H5 mandola), the parts of the instrument must be tuned to notes that use *A*430.6 as reference.

To be successful in this attempt, you should:

1) Believe in the premise of tap tuning.

2) Use a strobe tuner or software tuner that will enable you to modify the concert pitch to some note other than *A*440 (See Note 2 below).

3) Tune the instrument's parts to the notes whereconcert pitch is set to *C*=256.

4) Break in the instrument with hours of continuous playing.

Notes:
1) You can download a free musical frequency calculator (Excel® spreadsheet) from *www.siminoff.net* from the "Downloads" page (in the "Banjo and Mandolin Parts" section). This will enable you to set the fourth octave *A* to any frequency and read the frequencies for all the notes of the eight contemporary octaves.

2) Some tuners, such as the Peterson Model 490 or Model 590 strobe tuner, can be set to *A*430 (or any other frequency for *A*).