THE VACUUM TUBE RIDES AGAIN

The renewed interest in vacuum tube technology seems to be a reversal of Gresham's Law, a law in economics which says that bad money will drive out good money. An example of this is when our government decided to mint non-silver quarters. The silver quarters disappeared overnight.

Through the past 25 years or so, we have witnessed a deterioration of the art of the recorded sound as smaller, lighter, cheaper and easier to manage tools and technologies have driven the better sounding technologies to the brink of
extinction. How often have I heard salesmen of 'new' technology say that with his product, the home basement studio can sound as good as a $300 an hour professional studio. Unfortunately, many times they are right.

It isn't really that the home "project" studios sound so good; usually it is because so many professional studios sound so bad. If the professional studio records on a $1,000.00 DAT recorder that the home studio is also using, it
becomes quite hard to make it sound much better. We have been talked into the idea that digital recording is perfect and so we are forced into recording masters on a failed consumer format. It is lighter, cheaper, easier to learn to operate and maintain and it follows my thesis that the recorded sound quality has undergone a steady deterioration throughout the past 25 years.

VACUUM TUBES TO THE RESCUE! After hiding 'in the closet' for many years, many of the senior engineers admit that their home audio equipment is vacuum tube. Those old Marantz and MacIntosh amps are still cooking away. Most
audiophiles, the golden ear people who put their money where their mouth is, would never consider anything other than vacuum tube equipment and LP recordings. Certainly, most electric guitar players would never consider anything other than a vacuum tube amp.

Tube technology is over 100 years old. Thomas Edison, in an attempt to extend the life of the filaments in his light bulb introduced a positively charged 'plate' into the light bulb. While it did not extend the life of the filament, he did note that when AC current was applied to the tube, it was rectified to DC, the first diode electronic tube.

Much has happened since. Tube technology continues to be developed and improved. Both the American and especially the Russian military

establishments have continued to develop tube technology since, in the event of a nuclear holocaust, tube equipment would remain unaffected by high levels of radiation.

After the invention of the transistor, transistorized audio equipment began to appear almost immediately. The early transistorized equipment sounded awful but just as RCA advertisements around the First World War featured Enrico Caruso posed with a mechanical phonograph saying "I couldn't tell it from my own voice," people were sold on the idea that if it was solid state,
'state of the art,' it had to be better than the old tube equipment. They forgot one of the most important tests for new equipment - to listen to it and to A-B it with known equipment. Much has happened to solid state equipment since then, but for quite a number of technical reasons, transistors never equaled the musically acceptable sound of the vacuum tube. We at Sear Sound did some research into this and published our results in the Audio Engineering Society Journal in May of 1973.

Among other things, we found that in recording, instantaneous peaks arriving at the pre-amp of the console were as much as 39 dB above the overload point of the pre-amp. Tubes distorted by generating mostly 2nd harmonics (the octave) and even harmonics in general. Transistors produced odd and spurious harmonics often unrelated to the fundamental pitch. Tubes are voltage
amplifiers. They go into distortion on a gradual exponential curve. Transistors, when overloaded, saturate and simply clip when overdriven, producing these odd and unrelated harmonics which are certainly more unpleasant to the ear. Ask any organ builder.

Along comes digital recording. Again, we are told that we have finally achieved perfection in the recording art, just as we were told that the transistor and the RCA 'hill and dale' mechanical records were perfection. In combination, the transistor and digital recording have gotten so far away from a satisfying musical sound, that some 'fix' was sought. The vacuum tube rides again, to the rescue.

No matter what is done to digitize a musical signal, over sampling, bit mapping and all of the other 'fixes,' sooner or later we are stuck with a 44.1kHz sampling rate. Good engineering practice has stated that the minimum sampling rate to get a near emulation of a signal is to sample at 5 times the highest frequency. If we assume that the highest frequency is 20 kHz., then we should be sampling at 100 kHz.

Next comes the question, what is the highest musical frequency that we perceive? Well, it isn't 20 kHz. Try 200 kHz. As Rupert Neve and others have pointed out, many people can hear the difference between a sine and square wave at 15 kHz. which means they are hearing the first harmonic at least of the square wave, well above what is considered the upper limit of hearing.
Vacuum tubes love to work at high frequencies. Much of the 'classic' studio equipment generally was designed to go out to 22 kHz. with a 3 dB roll-off and then to fall off gradually to 50-60kHz.

By selecting too low a sampling frequency, we are condemned to eternal grainy digital sound, just as when the 525 line standard was adopted for television scan lines in 1947, we have been condemned to grainy TV pictures ever since.
This was a commercial decision. The economic need of consumer electronics giants to find a replacement for everyone's hi-fi equipment led to the development of digital technology which would obsolete the world's turntables. Indeed, CD's have many advantages. They are smaller, easier to store, less prone to physical damage and abuse and they made it possible for
the record companies of the world to take old, dead library material and to re-release it in the new format. This saved them a lot of money since the actual musical production costs were nil.

However, if you take a new digital re-release and play it next to the original LP and compare, there is usually an astounding world of difference.
Most of the musical life has gone out of the music when listened to on the CD. This is especially true of those recordings which were recorded on 35 millimeter magnetic film, by far the best magnetic recording format. Sorry, but the laws of physics don't change. The thicker the base, the wider the track and the faster the speed, the better the recorded sound.

Along these lines, this format was abandoned because the 35mm stock was considered too expensive and the equipment to record was considered too cumbersome. For the same reason, 16 track 2" recording was abandoned in favor
of 24 track recording. With over 40% less track area to record on, sonic quality was sacrificed to convenience. It is interesting to note that in the 1960's when we went to 8 track 1" tape, a 12 track machine was introduced. It was almost immediately rejected because engineers of the time heard the denigration in the sound quality. We still have 3 - 16 track 2" machines in operation at Sear Sound and we are happy to report that more and more producers are going back to this format. It sounds better,

and if you need
more than 16 tracks, we can slave 2 machines together.

The re-awakening of interest in vacuum tube equipment is a result of the musical sound deterioration that we have witnessed. RADIO WORLD, a publication for the broadcast industry, now runs a bi-monthly page entitled 'Tube Talk.' Vintage tube equipment prices are going through the roof. Old microphone manufacturers are offering re-runs of the old classic tube mics. New manufacturers are offering all kinds of new vacuum tube gear. What's going on? Maybe we are beginning to listen again. In my studio, the preferred
mastering machine is an Ampex 300 vacuum tube machine (at least 30 years old) 1/2 ", which we rebuilt to run at 30 IPS. Whenever we have done A-B tests with other machines, DAT recorders, solid state 1/2" machines and ADATs, the ancient Ampex wins hands down. The sound is described as 'airy', 'realistic', 'musical.'

My feeling is that we have been dealing with "The Emperor's New Clothes" syndrome. We have believed a lot of hype about new technologies and we have read spurious spec sheets about how good the new equipment is. Some of the
digital technology is superb but a lot of digital equipment leaves much to be desired as far as critical listening tests. The key word which we have forgotten is 'listening'.

Some of the myths that have grown up around vacuum tubes should be summarily dismissed. First is that they burn out frequently. I have a lot of equipment in my studio which has worked every day for thirty years. Although it would
be good engineering practise to replace them every generation, I haven't, and the equipment continues to work just fine. Another myth is that tubes are hard to find. Yes, certain German tubes from World War II are getting rare but tubes are still being produced in this country, Russia, China and many other countries. Matter of fact, tube prices haven't really gone up very much. I was restoring a 1929 RCA Theremin and I needed a tube. It was easily located and cost $5.00!

Vacuum tube equipment is back because 'it warms up the cold, precise digital sound.' Regardless of the theory, the return of vacuum tube equipment to favor is because it sounds better and it has always sounded better.

BIOGRAPHICAL NOTE:

Walter Sear has worked as a professional musician for 40 years, performing with The Philadelphia Orchestra, Goldman Band, Symphony of the Air, Sound of Music Orchestra, Radio City Music Hall and numerous recording sessions in New York City. He helped to introduce the original Moog Synthesizer and had one
of the first commercial electronic music studios in the world. He has operated SEAR SOUND for the past 30 years, a recording facility which is still primarily a vacuum tube studio.

Walter Sear