The Les Hall Show

www.electro-music.com

by Les Hall

In December of 2008 I posted a message in the "Strings and Things" forum of www.electro-music.com in which I wondered if there might be some totally different way to do the job that a guitar pickup does. That thread is here:

http://electro-music.com/forum/viewtopic.php?t=31138

I proposed the possibility that a tiny current might be induced by the pickup magnets in the strings (according to Physics it must be, however it is quite small), and that this current might be large enough to be detected. 10 hours later my friend DrJustice posted in agreement that this might work. Long story short, I'm looking at the guitar right now and indeed it does work. It's been sitting there gathering dust in my living room for close to three years now.

Other posters contributed some thoughts but the main effort was between DrJustice and myself - we quickly exchanged email addresses and planned to patent the invention, a plan that never happened. DrJustice was busy with work so his contribution was to be part of the

exchange of ideas, the imagineering of the thing - and a few hundred dollars in cash. I had no job and plenty of time so once we had done the imagineering I used the cash to buy some parts and modified my guitar with the new invention. Here is a photo of the completed guitar:

In the image you can see that it's a black and white Fender Squire Strat guitar and you can also see the way cool chainmaille guitar strap that I created for it. If you look closely you'll notice some metal plates under the strings that have magnets attached to them. Here is a close-up of that detail:

This image is the key to how the whole thing works because the electrical signal is generated right here by the electro-magnetic interaction of the magnets and strings. The rest of the invention is all

about getting the signal and amplifying it, but creating the signal itself happens here.

It happens according to Faraday's Law of Physics, which I will not get into much because I don't remember too much about it from college, which was about 20 years ago for me, and also because the details of the Physics involved are not necessary for a general understanding of how this pickup works. Just know that when a metal conductor such as a guitar string moves within a magnetic field, an electrical current is generated in the string. According to the right hand rule applied to this physical arrangement, the current will travel along the length of the string.

So the string vibrates in the magnetic field and this induces a current to flow up the string to the headstock. That's good, but the jack is back in the guitar body and we need to collect the six string currents and send them back to the guitar body somehow. After some experimentation I found that simply shorting the tuning pegs does the job of combining the string currents into a single electrical current, and here is a photo of how I did that:

I fashioned metal lugs out of tuna can lids (which took forever with a Dremel tool, but I was eager to make this work) and carefully soldered the lugs together in just the right spacing to fit properly. The next thing was to get the signal back to the guitar body which I did with a piece of wire. I covered the wire with electrical tape to somewhat protect it, but the real solution on a working guitar is to use the truss rod as a return

conductor. Either way you do it, you get the signal to the body of the guitar and there you need to amplify it because it is a very tiny signal.

There are two ways to accomplish this amplification: with a transformer or with an electronic amplifier. We chose to use the transformer approach because it is a totally passive solution meaning the guitar would not need a battery or solar cells or any type of power cell. The disadvantage of the transformer, we later learned, is that it does not really deliver the higher end signal all that well due to bandwidth limitations of the transformer. This might be improved with a larger transformer though, so it is not finally decided which solution is best overall. I guess it really depends on whether you want a battery in your guitar or not.

Well, the guitar works and it plays with it's own unique sound and a collection of secondary characteristics that are quite interesting. Not all guitarists like the sound. In fact, most of them don't like it because it sounds more acoustic and more harmonious which is not the harsh, dirty sound that so many enjoy from an electric guitar. So this pickup invention may be more suited for Bluegrass, Jazz, and classical instruments such as violin or harp or piano, where a "clean" sound is preferred.

Once we got the guitar all working we decided to get a patent on the invention which never happened for various reasons. We did do the first step, however, which was a patent search and that is when we discovered that our idea had been thought of before. Long before in fact, as the earliest patent we found went back to 1936! This means, if I understand it correctly, that this guitar pickup type actually predates the 1950's wound coil style of electric guitar by some 10 to 20 years. So it was an early concept, but it took until today when powerful super magnets and sensitive mu-metal shielded transformers became available for the invention to become practical.

Once we had studied all the prior art in the patent record, we ended up with a few unique improvements to the overall design, mainly that our

circuit geometry allowed for a grounded bridge so it can work without a specially made insulated bridge. This is key for working the design into modern guitars and other stringed instruments. We also contributed the notion of hexaphonic output where the individual string signals are sent out to six separate guitar amplifiers instead of being combined into one signal (as an optional configuration).

So where do we stand now with the guitar invention? It's going nowhere fast. I tried to get guitarists interested in it on forums and web pages but none showed much interest. I approached the guitar industry and was told to hire an attorney - apparently they take an antagonistic approach to the whole thing. I approached individual musicians and none of them showed any interest in the guitar. Finally, I made a web page which is here:

http://echuck.othomann.de/eChucK/Guitar_Kit.html

On this web page I give enough detail about the setup to make your own guitar, and I ask for a ten dollar contribution per guitar that you make. So far not one person has sent me the ten bucks. We do get about one hit a day on the web site and I did make mention of the site and the invention to a community of academics who make their own stringed instruments and modify existing stringed instruments, telling them that the $10 donation is waived for academic and personal use.

But I don't' really care about making money anymore, the government pays my rent and though I am poor as dirt I have what I need. The point is that this pickup, originally conceived in the 1930's, is a practical alternative today. Maybe someone listening to the radio show or reading this document will choose to make use of the invention and it will find some use, I don't know. It's depressing sometimes, the things that I create that never seem to go anywhere, but I have so much enjoyment and personal satisfaction from the creative process that I just can't stop creating. I'm addicted to imagineering, and that will never change.