



By C.J. Huss

Chapter Fifteen
As We Sail Into the Mystic(al) - Part 1
~~~(Or...Wire We Doing This?)~~~

Waaaaay back in Chapter 6 of these here technorambles, I duly noted the following premonition:

In a future column, I'm going to get into the subject of cables (speaker, interconnect, etc.) and the supposed vs. real effects they have on the accuracy of an audio system. Yes, I'm that foolish, but as a man of science, it perturbs me greatly to see people spend sometimes huge sums of money on products more grounded in mysticism than reality.

And, well...methinks the future is here, faithful readers. Yours truly is about to risk the wrath of the audio marketing gods to dive into the skinny on the science behind what normally seems like a humble partner in the overall audio chain of events from source recording to speaker—wires and/or cables.

Wait, you say—isn't pretty much everything wireless, these days? I mean, yeah, there's still those power line things on the big wooden poles outside your domicile, but hasn't that old technology been replaced for things like TVs and stereos? A fair question, to which the answer is...no.

Even if your current stereo consists of a smartphone offering a wireless connection to your home's smart speakers, there are still always wires of some kind in play, even if they are represented by tiny circuit board traces inside the respective components. Electricity can propagate either as a pure electromagnetic energy field, or as a stream of electrons (a "current") flowing in a conductor. But in order to perceive the information that the electricity carries, at some point it needs to interact with conductors of some sort, simply because we can't hear the energy field directly.

But, let's back up just a bit to recognize that many of us, and not just geezers like the one writing this column, still listen to our tunes on a traditional stereo (or even surround sound system) that has wires connecting our turntables, tape decks, CD players, radio tuners, and sometimes more to an amplifier or receiver, and then from that component to speakers. And if so, it's very possible you may have heard about or read that the construction of these wires plays a critical part in the quality of the sound reproduction the system as a whole can offer. So—is this true? Another fair question, to which the answer is...

Yes, and, mostly no. Or often no, and sometimes yes, with stringent qualifications. There is sometimes honest disagreement among both engineers and the audiophile community, but one thing I wish to state with the bulk of reputable audio science behind me is that whatever differences there are in types of wire or cables, as long as the essential electrical requirements of the circuit are met, audible differences are small to non-existent.

How did this coppery conundrum all start, anyway? Quite legitimately, as it turns out. Back some fair decades ago, as much better audio gear was making its way onto the market, there were engineers who noted that much of the speaker wire being provided for use with these new components was fairly thin, or "small gauge" to use a tech term. Now, back when many stereos folks owned were lucky if there was even a five or ten watt amplifier inside them, small gauge wire was perfectly adequate, especially if it only needed to run five or six feet from the amp out to each speaker, and/or if the speakers lacked extended bass response.

Why would the length or gauge of the wire matter? Because even a good electrical conductor like copper has resistance to the flow of electrons passing through it. The thinner the wire, and the longer the length of it, means greater losses in the signal. So, one engineer of those mentioned above ended up starting a company that for its first product provided rolls of wire that were much thicker than what was commonly used previously. In terms of gauge, this newer wire was usually at least 16 or 14 gauge, and could even go up to 12. What do these various gauges look like, and why does the bigger wire get a smaller number gauge? Can't answer the latter question, but here's a handy graphic re: what the sizes look like, plus some additional info:

Win At Trivia Contests With This Useful Engineering Data!  
(or perhaps make annoying guests go home early)

| wire gauge # | diameter in inches | which looks like | resistance (ohms) per 10 feet | resistance (ohms) per 50 feet |
|--------------|--------------------|------------------|-------------------------------|-------------------------------|
| 10           | 0.1020             | ○                | 0.010                         | 0.050                         |
| 12           | 0.0808             | ○                | 0.016                         | 0.080                         |
| 14           | 0.0641             | ○                | 0.026                         | 0.130                         |
| 16           | 0.0508             | ○                | 0.041                         | 0.205                         |
| 18           | 0.0403             | ○                | 0.065                         | 0.325                         |
| 20           | 0.0320             | ○                | 0.104                         | 0.520                         |
| 22           | 0.0254             | ○                | 0.165                         | 0.825                         |
| 24           | 0.0201             | ○                | 0.262                         | 1.310                         |

Remember that a 25 foot run of cable from amp to speaker actually has two wires, one out and one back. So if for example you used the thinner 24 gauge wire, the total resistance is 1.3 ohms. If your speaker is 8 ohms, approx. 1/6 of your amp's power is being used up just in the speaker wire! For a 4 ohm speaker, it's nearly 1/3 !!

So, as noted in the graphic, if you have speaker wire that is too thin, you'll lose music. How much? We'll need a bit of math here to explain, but don't worry, it's pretty basic if you aren't a number-head. To start, I'll bring up the three most critical words in the world of current electricity—volts, amperes, and ohms.

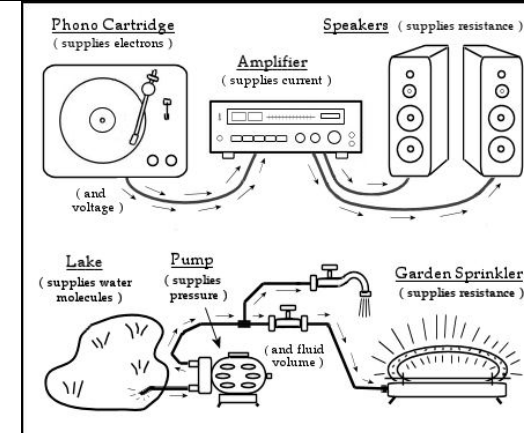
Volts are a measure of pressure, the force needed to make electrons flow through a conductor. Think of a plumbing system, with water flowing through pipes. Pressure is needed, via gravity, a pump, something, or the water will just sit there in the pipe. Voltage measures the amount of pressure. In the olden days, it was often referred to as electro-motive force, or EMF for short.

Amperes, or amps for short, represent the quantity of electrons present in the conductor. In the plumbing terms, it would be the volume of water in the pipe. Now—does it seem logical that if there is more water in the pipe, more pressure is required to move it? Yes indeed! And if the pipe is bigger, and holds more water? Uh-huh, yep. See, easy math!

Ohms is a measure of resistance to the flow of electrons in the conductor. In our plumbing analogy, even if the walls of the pipe are fairly smooth, there is still some drag they will impose on the flow of water through it. And then there is the resistance imposed by whatever is at the end of the pipe, say a faucet, or showerhead, that affects how much water can be moved through the pipe over any interval of time.

So think of—a pump, water through a pipe, a garden sprinkler. Now a record player, an amplifier, speakers. And—pipes/wires. Make sense? And if the pipe is too small, or runs too long a distance, your sprinkler will be dribbling, not sprinkling.

So thicker speaker wire can be truly beneficial, especially if you have a hefty amplifier, say 100 watts or more, or speakers that need more power from that amplifier than average, as some speakers will. But how thick, and are there any other characteristics of the wire besides the thickness that are important?



Oh dear...(passage of time)...(science and mysticism begin to intertwine)...(marketing departments become aware that burger joints make more profit from the cheese option than the burger and apply this dictum to non-burger products)—(obscure high-end quantum mechanics begins to creep into the engineering of wire, and then also into cables)...oh, oh dear.

Cables? So what's the difference between a wire and a cable? (sigh) Sorry, gentle readers, we've come to a temporary rest stop in this electronic river of time. But fear not, we shall continue our intrepid voyage in the next column, and with more nifty pictures to show off exciting wirey inventions like dual-shielded coaxial cable, noise-cancelling twisted pair cable, balanced lines...ooo, yeah, and... guaranteed magic-free science stuff!

Until then, as always, try to mostly go with the flow,

Happy tunes,

-- CJ



Some of the key players for the evening, from l: Brandon Valentine, CPMA founder; Alan McCutcheon podcast co-host; Jenny Clay and Chris Garrett CPMA co-hosts and Daniel Keim, podcast co-host.

3rd  
CPMAS  
CENTRAL PENNSYLVANIA MUSIC  
AWARDS

March 24, Hershey Theater, Hershey, Pa.



The Suicide Puppies, one of the finalists for Best Metal Band, are shown with two past KRC presidents: Phil Schwartz, left and Roy Robbins.



John Clemente, author of the definitive book on girl groups, met with The Pixies Three's biggest fans, Jim Metzger and Denny Pine.



Even Batman was in the house!