

SQUARE WIRE TECHNOLOGY

NEW VOICE COIL GEOMETRY

Conventional loudspeakers typically use two layers of round wire to convert electrical signals to mechanical motion. The voice coil produces a magnetic field (electro-magnetic field) that interacts with the permanent magnetic field and the result is a force that produces the cone motion that generates acoustical energy.

A typical two layer, round wire voice coil is shown in Figure 1. This voice coil geometry is not a very efficient design. The areas between the winding use up physical space and limit the amount of wire available to produce the electro-magnetic field needed for an efficient energy conversion. These areas are shown in Figure 2. The red arrow shows the areas where the round geometry prevents electrical conductor from contributing to the overall conversion of electrical to acoustic energy. In addition to this inefficient use of space, the two layer design shows the outside layer in direct contact with the air in the magnetic gap, but the inside layer is trapped between the outside layer and the coil former. The position of the inside layer does not allow efficient heat transfer so the inner layer does not cool as well as the outside layer. This lack of efficient cooling acts to put additional stress on the adhesive systems of the assembly and reduces the loudspeakers reliability. The additional heating also acts to reduce the electrical current flow into the loudspeaker and reduces system efficiency and output.

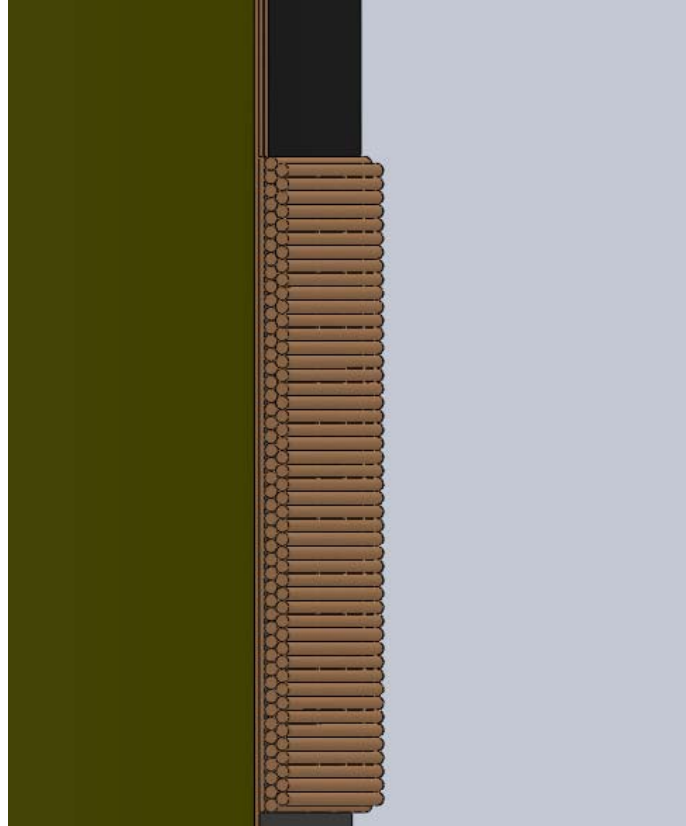


Figure 1

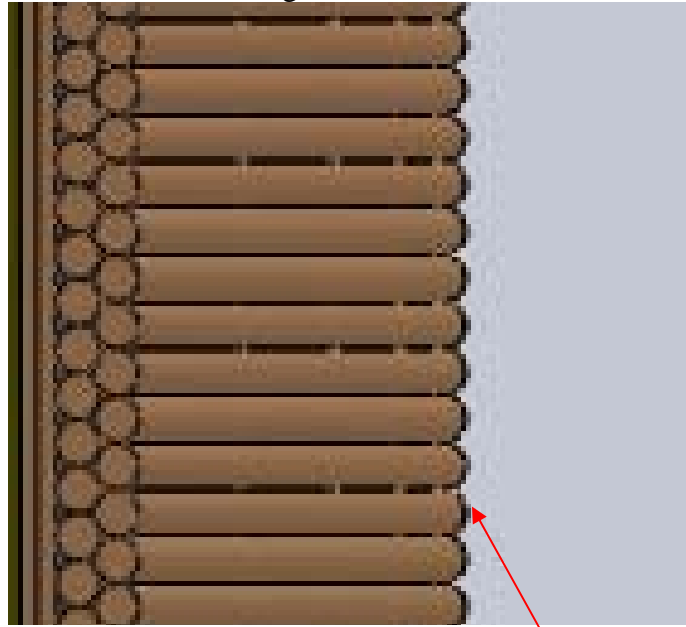


Figure 2

The red arrow shows the areas where the wire geometry prevents conductor from improving the overall loudspeaker efficiency. The round shape of the wire does not allow for a high density of conductor in the magnetic gap of the loudspeaker.

A method used by higher performance designs is that of a single layer rectangular geometry. A single layer rectangular construction is shown in Figure 3 This geometry allows more electrical conductor in the magnetic gap and also provides superior wire cooling. Figure 4 shows the area between the wire winding and how much smaller this area is then in the round wire voice coil design shown in Figure 2.

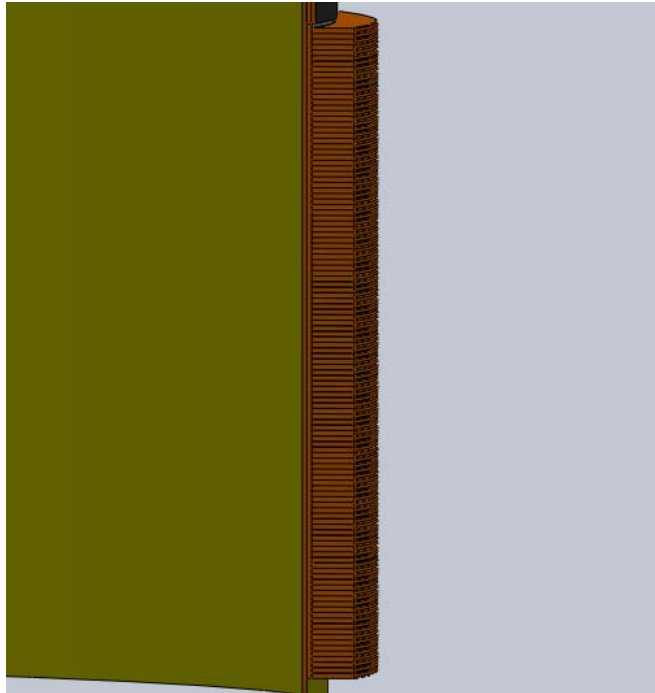


Figure 3

In addition to providing the basic electrical energy to mechanical energy conversion, loudspeaker voice coils are the primary method of “heatsinking” that energy once the majority of it has been converted to heat. To be an efficient heatsink, the voice coil must have a large area. This is one of the main reasons that larger diameter voice coils offer higher power handling, they offer larger cross sectional area and these larger areas offer superior cooling. Voice coil winding area can be thought of as acting in exactly the same way as a large heat sink acts to cool the output devices on a professional power amplifier.

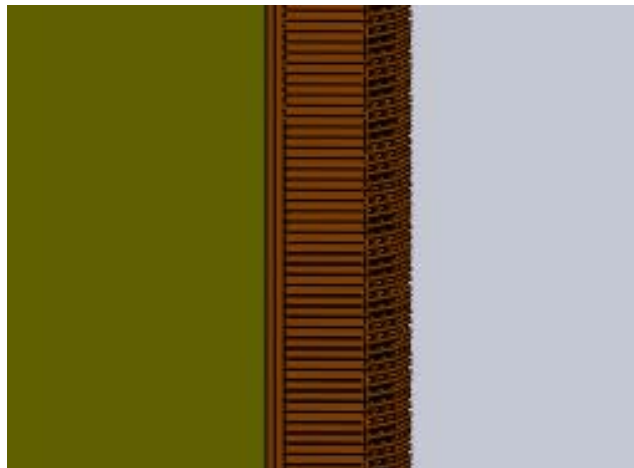


Figure 4

P Audio has employed a winding geometry known as “inside/outside” geometry. This winding geometry is shown in Figure 5. The wire size is adjusted so that the voice coil can be wound on BOTH the inside and outside of the coil form. This method basically doubles the available “thermal radiating area” of the voice coil and further improves the voice coil’s ability to radiate heat away from itself.

In addition to utilizing “inside/outside” voice coil geometry, P Audio has also developed a square wire geometry that allows even higher density in the magnetic gap. The net result is superior cooling, higher power handling and reliability, and higher conversion efficiency than other voice coil winding geometries. P Audio is able to provide new levels of power handling and new levels of reliability.

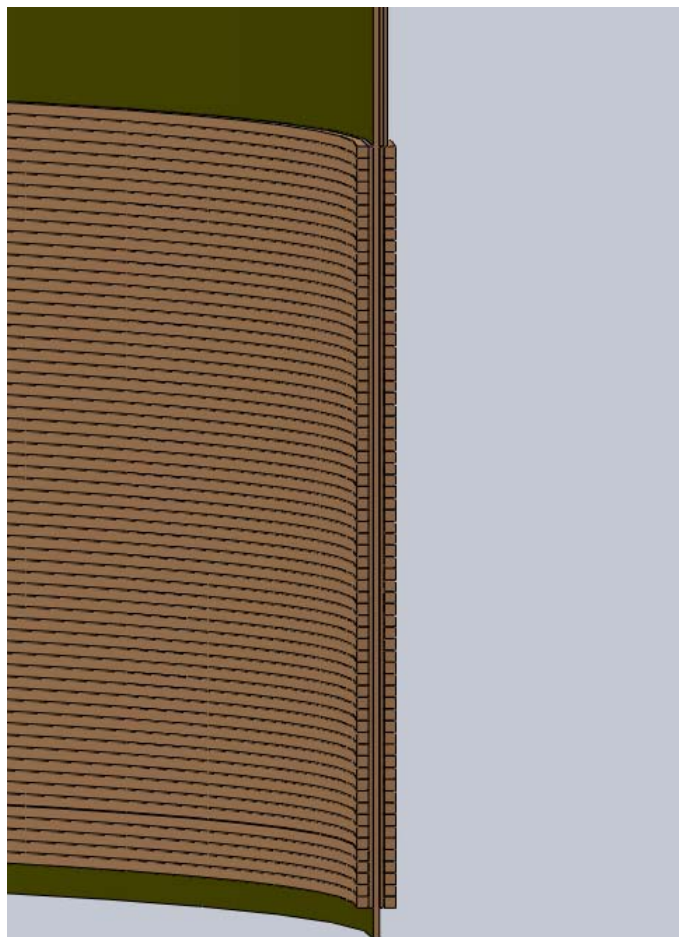


Figure 5