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HOW TO BUILD A 100 WATT LOUDSPEAKER

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Over the past decades there has been a continual increase in the power ratings of amplifiers and loudspeakers. Fifty years ago, a high-fidelity valve amplifier for home use typically had a power output of 5 to 10 watts, whereas now the figure is in the range 50 to 100 watts. In entertainment venues the power rating is much higher. The same thing has happened to loudspeakers, and there is now a substantial demand for speakers with power rating of around 100 watts. The problem is that these loudspeakers are often expensive, so it is interesting to know that there is actually a simple and cheap way to convert a speaker of, say, 10 watts rated capacity into a genuine 100-watt speaker.

The simple electronics behind this conversion is shown in Figure 1. To be satisfactory, of course, the new loudspeaker must match the output impedance of the amplifier, which we have assumed to be 8 ohms. It is, perhaps, somewhat surprising that this simple arrangement achieves its objective, and gives a frequency response as good as that provided by the original 10-watt speaker .

There is, however, a simple reason for this. When a loudspeaker is referred to as being "100 watts", then what this means is that it can accept an audio signal of strength 100 watts without burning out the voice-coil. The rating says nothing whatever about the acoustic power output. It is clear therefore that, provided the resistor R_1 in Figure 1 can dissipate about 70W and R_2 about 20W without being destroyed, our "100-watt" loudspeaker meets the generally used definition. But what does this mean in terms of sound output?

A typical high-quality loudspeaker, mounted in an enclosure, produces a sound-pressure level of around 93dB/W at a distance of 1 metre on-axis. If it is assumed that sound is radiated uniformly in all directions, then this amounts to just about 20mW of sound power per watt of electrical input power, or a conversion efficiency of 2 percent. If the sound radiation is directional, as it certainly is at high frequencies, then the conversion efficiency will be less than this. Loudspeakers designed to reproduce a very limited frequency range can do a bit better than this, but conversion efficiency is always less than about 10 percent. A nominal "100-watt" speaker thus produces about 2W of audio power if driven to its limits by a 100W amplifier. The design in Figure 1 will only produce about 0.2W or 200mW under the same conditions, but one might ask "What is the significance of an extra factor of 10 when the original description is misleading to the extent of a factor of 50?"

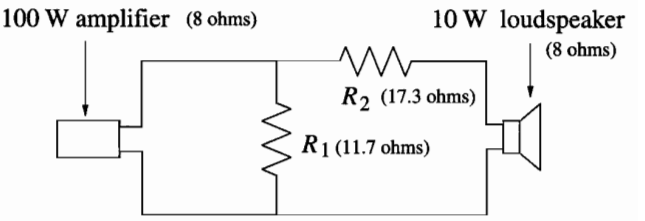

Figure 1. Circuit for converting a 10-watt speaker with internal resistance 8 ohms into a 100-watt speaker. The circuit shown still presents and impedance of 8 ohms to match that of the amplifier. The speaker dissipates a power of 10W and the remaining 90W is shared between R_1 and R_2, with R_1 carrying most of the load.

Sales managers might object, but is it not time that the acoustics community did something about these misleading specifications?

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