

Loudspeaker

Introduction

Have you ever wondered where the sound came from in your computer speakers or car stereo? Believe it or not, they use *magnets* to reproduce the sounds you hear! A speaker is actually relatively simple in design, but quite complex in function.

History

Originally developed and patented by Scots inventor Alexander Graham Bell in 1876, loudspeakers first saw use in early telephones. The next year, a German inventor named Ernst Siemens produced an improved version of Bell's speaker. Most drivers of the day operated on compressed air rather than electromagnets. The design that would serve as the basis for modern speakers was not created until 1898, by the English physicist Oliver Lodge. The first application of Lodge's design was in public address (PA) systems by the future founders of major electronics company Magnavox (*Loudspeaker History*). A patent for the type of driver most similar to those used today was granted in 1924. These early drivers used electromagnets exclusively due to the low availability of affordable standard magnets at the time. Over the years, the design of coil-driven speakers has evolved and incorporated new advances in engineering to produce clearer sound in a more compact system.

Components of a Loudspeaker

A common speaker consists of seven major working parts shown in the diagram below.

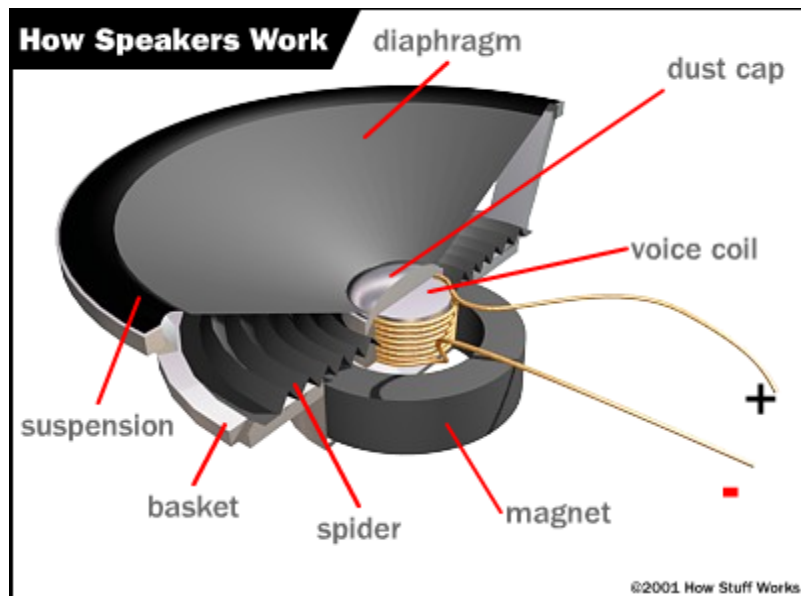


FIGURE 1 *Cutaway View of a Typical Loudspeaker*

Source: *How Speakers Work*. How Stuff Works, ©2001

Perhaps the most important part of the speaker design is the **voice coil**. This is thick loop of metal wire housed inside a donut-shaped **permanent magnet**. The coil is hooked up to a power source that constantly changes the way electricity flows (called Alternating Current). The Alternating Current creates a magnetic field around the wire, which repels the permanent magnet and causes the coil to move back and forth.

A flexible ring of coated fabric called the **spider** at the end of the coil allows the entire coil apparatus to move freely. Attached to the coil and spider there is a large cone made of paper or another stiff material, known as the **speaker cone or diaphragm**. When the coil moves, this cone vibrates to make sound waves. Different levels of sound are generated depending on the speed of vibration. Smaller cones (tweeters) vibrate faster, producing higher sounds, while large cones (woofers and subwoofers) vibrate slowly and generate very low sounds.

On the outside of the cone, protecting the narrow hole leading to the voice coil, is a small dome-shaped **dust cap**. This simply serves to keep dust and debris from getting into the delicate voice coil. Finally, enclosing all these components is a metal **frame or basket**. Around the wide rim of the frame and speaker cone, a rubber or plastic ring called the **suspension** holds everything in place and dampens excess vibrations.

Significance

Speakers are present in a wide range of electronic devices. Some of the more common applications are home theater systems, radios, televisions, public address (PA) systems, and musical instrument amplifiers. The basic driver design has become such a significant part of our daily lives through such products that we see and use every day.

The advent of electronic speakers opened up new possibilities in communication and entertainment. They allowed people to address larger groups with early PA systems. They revolutionized music playback, replacing older drivers (which used compressed air instead of magnets) with a more compact and clearer-sounding alternative (Olson, 1962). Without modern loudspeakers, music as we know it today would not be possible. In that sense speakers have had an important cultural impact as well.

References

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Olson, H.F. (1962, May). Loudspeakers. *Proceedings of the IRE*, 50, Retrieved February 09, 2009, from http://ieeexplore.ieee.org/xpl/freeabs_all.jsp?arnumber=4066767