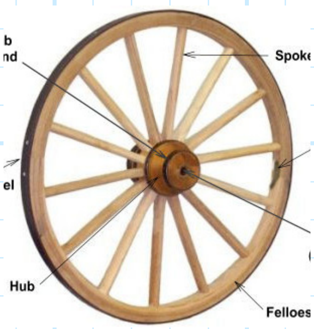
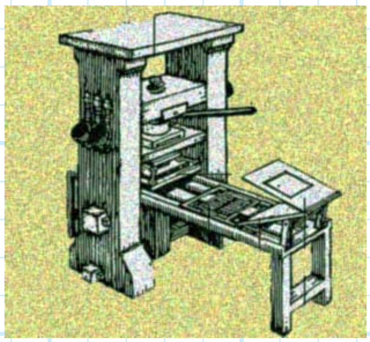
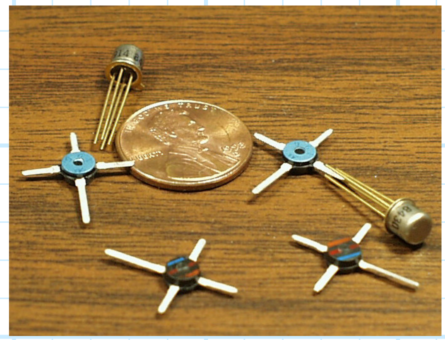
RF Transistors

The transistor—this three terminal device has turned out to be one the most significant inventions in **human history**!





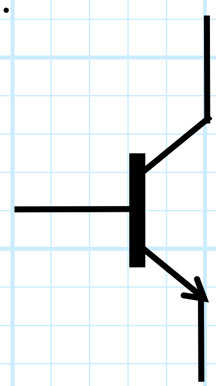


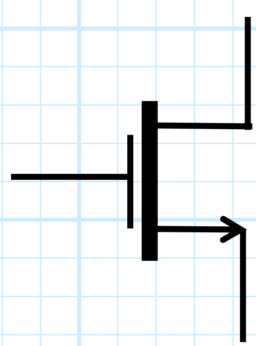
Its application to **digital** devices and machines get all the press, but they are of course equally invaluable for **analog** applications, including RF and microwave.

Specifically, a transistor allows for us to generate **signal gain**—to transfer energy from a DC source and apply it to an RF signal, without otherwise distorting that signal.

Because of this, we can build two crucial items for most microwave systems: a microwave **amplifier** and its **unstable** cousin, the microwave **oscillator**.

This microwave devices are made from the usual suspects: Bipolar Junction Transistors (**BJTs**) and Field Effect Transistors (**FETs**).





However, we find in microwave applications that these transistors are often (but not always) formed from a different semiconductor **material** than the usual **Silicon** (Si).

Instead, we find that microwave transistors are often made using the semiconductor material **Gallium Arsenide** (GaAs).

Gallium Arsenide has many practical problems associated with it, but it simply has higher carrier mobility than does Silicon. In other words GaAs is ***faster*** than Si.

Thus, if we wish to build amplifiers and oscillators at the **highest** microwave frequencies (e.g., >18 GHz), we must use **GaAs**!

Among the problems with GaAs is that we **cannot** construct Metal **Oxide** Semiconductor FETs (MOSFETs), devices which are the most prevalent technology used in digital applications.

As a result, GaAs FETs come in a variety of designs and types, with perhaps the most prevalent being the MEtal Semiconductor FET (MESFET). A full description of micro wave transistor types is found on page 522 of your book.