

4.4 Pickup Magnets

There are several methods to detect the vibrations of a string and to transfer the movement into an electrical current. One of these methods is based on the induction principle: A magnetic field varying with time induces (produces) an electrical voltage in a conductor loop (wire winding). Pickups based on this working principle are called magnetic pickups. The magnetic field is produced by a permanent magnet and is time-dependently modified by the vibrating string.

The magnets of most Fender and Gibson pickups are fabricated from **AlNiCo** alloys and this basic materials is also of special importance for other manufacturers. Permanent magnets are known from ancient times. However, efficient permanent magnets have been only available since the beginning of the 20th century. At first C-steel magnets were in use and improvements were achieved with Cr and Co-steel. In the middle of the 30s the **Mishima-Metal** (13,5% Al, 28,5% Ni, the remainder Fe) was developed in Japan and a little later the **MK-Alloy** (13Al, 25Ni, 4Cu). At the beginning these alloys were still called *steels*. Nowadays, the word steel stands for carbon containing steel and carbon is undesirable as a constituent in AlNi or AlNiCo alloys so today these are called magnet alloys. **Alnico alloys** contain **Aluminum, Nickel, Cobalt**, copper, **Titanium** and other additives in addition to the main constituent iron. The first alloys were fabricated without cobalt, so they are sometimes called AlNi magnets, but sometimes also AlNiCo-magnets even though they do not contain cobalt.

The history of the AlNiCo magnets begins around 1935, at a time when the first commercial pickups were developed in the USA. Gibson built a magnetic pickup into the Hawaiian Electric, which contains a huge 11 cm long horseshoe magnet made of steel. The developer was **Walter Fuller**, however the pickup was known as the Charlie Christian pickup after the artist who used it for the first time in public. Alnico magnets were first implemented at Gibson in the 40s. At the end of the 40s Walter Fuller launched a new pickup with a bar magnet and considerably smaller dimensions, the **P 90**, which is still in production. Nearly at the same time Leo Fender started the production of the Broadcaster, which was renamed to **Telecaster** shortly afterwards. It was also equipped with AlNiCo magnet pickups, however the magnets were formed as cylinders.

One of the first Alnico alloys produced in the USA was **Alnico 3** (or Alnico III). The Al content is 12%, with 24 – 26% Ni and 0 – 3% Cu added. Co was not yet included. The somewhat stronger **Alnico 2** alloy contains 10% Al, 17 – 19% Ni, 12 – 13% Co and 3 – 6% Cu. The even stronger **Alnico 5** magnets were available at around the beginning of 1940 with 10% Al, 17 – 19% Ni, 12 – 13% Co and 3 – 6% Cu. In the following years a multitude of new magnet materials was introduced which in the case of Alnico were supplemented with numbers and additional letters. Patents and trademarks protect the mixing recipes and trade names, which leads to an ever growing number of designations: Nialco, Ticonal, Alcomax, Hycomax, Hynico, Ugimax, Columax, Coerzit, Oerstit, Gaussit and many others. In the 50s a new type of magnet became available that does not require expensive alloy constituents. Within a short time **ferrite magnets** make it to the top of the magnet market. With the beginning of the 70s a new class of high-performance rare earth magnets is available with a five times higher energy density. The pickup producers, however, soon realize that strong magnets not only increase the volume but also change the sound. This is why, in the course of a return to old values, it was necessary to declare Alnico as the favorite material again.