Headphone Selection Procedure for Crystal Detector Radio Receivers

OddMix.com - Crystal Radio Note - CRN0809 - Karl Nagy

Figure 1. Headphones Collection

Many of us collected quite a few different headphones from many different sources. These have all different sizes, shapes and impedance. Now we would like to use one for our just completed crystal detector radio. This note will help to find the best possible headphone to choose

Figure 1 shows a few different headphones. The largest black stereo headphone belongs to a Sony **cassette player**. The large single one on top is from a telephone headset. The silver colored stereo set belongs to an MP3 player and the white mono on the right arrived with a transistor radio. The tiny dynamic speaker is made for a very small transistor radio.

As shown on **Figure 2**, one side of the headphone is connected to the crystal rectifier **diode** and the other terminal is to ground. **Resistor** R1 and **Capacitor** C2 are also connected to the same place. Do NOT use C2 with crystal headphones. It is also easy to see that the resistance of a magnetic headphone will load, or draw audio current from the crystal. The smaller is the headphone resistance the larger this loading would be. There is not much voltage available across the tuned LC circuit, and almost any load on it is too much. In order to maximize the available sound, we should try to select a headphone with the highest possible resistance, because that will load the tuned LC circuit the least.

The best possible load for our purpose would be one with an infinite resistance or no loading at all. Unfortunately, among the magnetic headphone collection, we can't possibly find one like that. Magnetic headphones are all constructed the same way. Their working is based on the discovery of the electromagnet. A coil of fine wire made up each of the working coils. The more turns the coils have, the more sensitive the headphone will be. In **Figure 3**, the steel membrane shown in blue color is in close proximity with the coils. The distance is adjusted to as close as possible, to just before it touches the surface of the coils. The coils are biased with a permanent magnet.

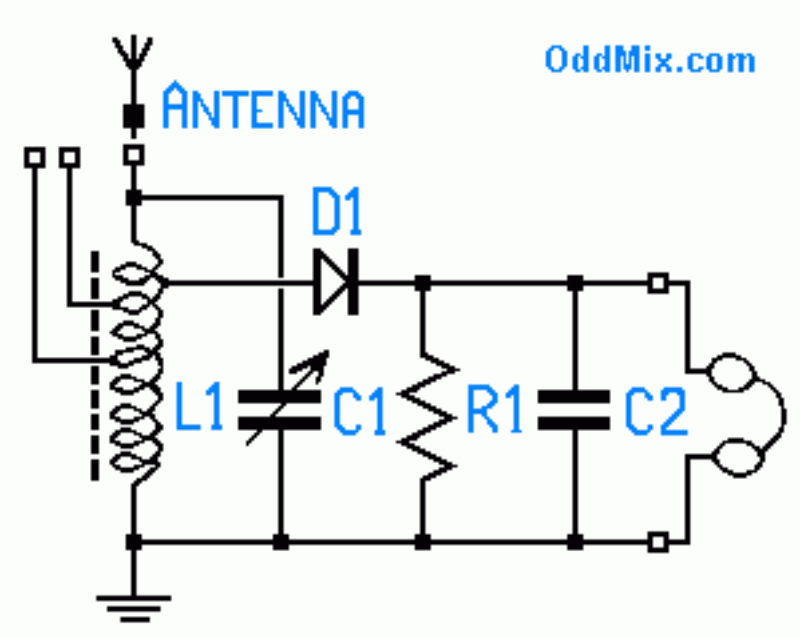

Figure 2. Crystal Detector Radio

A magnetic headphone cross section is shown on **Figure 3**. Same of the better headphones, usually older units, have a dual coil assembly, exactly like on **Figure 3**. Most of the current production has only one coil in the center with a few turns only.

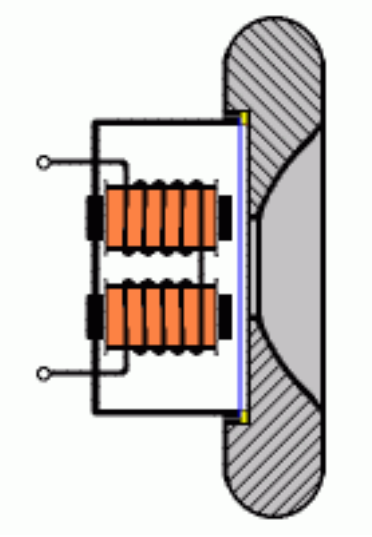

Figure 3. Magnetic Headphone Cross Section

The older, two-coil headphones used to have 2,000 ohms resistance per coil. With two coils in series, a headphone like that will present a 4 kilo Ohm, usually the smallest preferred load resistance.

Luckily, a crystal headphone has very high resistance and excellent audio hi-fi quality. Unfortunately they are not as common as the cheep magnetic phones. In fact they are quite rare and hard to find. To find out if you may have one or more crystal phone, just measure every headphone you have with an ohmmeter. Select the highest resistance from the lot. For the stereo phones, use only one side at a time for measuring. The readings should read at least 4,000 ohms or higher. If a working headphone is found with much higher resistance that is a crystal headphone. A crystal headphone has no measurable resistance. With a crystal headphone do NOT use C2.

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