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Hello Monitoring Times Readers!

I'm delighted to be sitting here at my computer tapping out the first of what I hope will be many "Radio Restoration" columns for *Monitoring Times*. Some *MT* readers may know me as the long-time Antique Radio columnist for Gernsback Publications (I started with *Hands-On Electronics*, continued with *Popular Electronics* when *HOE* became *PE*, and finally served for several months on *PE*'s sister magazine *Electronics Now*).

With my transfer to *Monitoring Times*, I'm looking forward to introducing many new readers to the lure and fascination of restoring antique radio receivers and to encouraging those already in the hobby to get even more involved! It goes without saying that I also welcome those of my old readers who already read *MT* or who, I hope, will eventually find their way to these pages.

The main thrust of the new column will be hands-on restoration work. Together, we will pick up soldering iron and multimeter to restore vintage receivers, test equipment, and related high-interest antique electronics items.

Those of you who may be familiar with my old columns know that I never prepackage completed restorations to write about them after the fact. I prefer to have readers right at the workbench with me as I go through a radio, sharing the ups and downs of the project in real time. You'll be looking over my shoulder as I swiftly and masterfully make a creaky old set functional once more – or as I scratch my head over a restored radio that stubbornly refuses to talk.

MT's Editor Rachel Baughn and I have had several long telephone chats about how best to get this new column started. We decided that the first several issues should be targeted to readers who are new to the antique radio hobby. I'll begin by giving you an overview of the "universe" of old sets out there to be collected.

We'll trace the evolution of broadcast and shortwave radios and discuss typical sets at various points along the path. That way, as you explore radio meets and garage sales in search of your quarry, you'll be able to look at potential acquisitions with a more knowledgeable eye. And you'll be in a position to form some opinions about the types of receivers you'd eventually like to have in your collection.

Once you've acquired an interesting set or two, your thoughts will inevitably turn to restoration. How can you make your discoveries play like new and, hopefully, turn them into showpieces you'll be proud to display in your home? Accordingly, we'll follow up the overview material with some information about how to set up a basic radio restoration workbench: the tools you'll need to start with; the safety precautions you'll need to take; the test instruments you'll need to begin accumulating.

With your workbench established, we'll turn our attention to some generic radio repair techniques; techniques that you'll be using on almost any set you'll be bringing into your shop. These will include the standard housekeeping procedures that may very well bring your set to life with no further attention – or at least simplify and facilitate any later trouble-shooting that may become necessary. We'll also cover simple and effective techniques for carrying out that trouble-shooting.

Once all this ground work is laid, we'll start some actual radio restorations – beginning with simpler sets and gradually progressing to the more sophisticated ones. And I sincerely hope you will have as much fun with all of this as I expect to!

Our Starting Point

Though radio had its origins in the first years of the 20th century (some seminal discoveries having taken place even earlier), we'll begin our evolution story in the early 1920s, just after the conclusion of World War I. Why this particular starting point? Radio (or "wireless," as it was then called) communications were certainly taking place before that time. However, most of this activity involved point-to-point connections for maritime or military use. Not much of the equipment employed then has survived today, and the little that is now accessible to collectors is very high priced. It's exotic stuff!

However, the development of radio technology – particularly vacuum tube technology – that was stimulated by World War I set the stage for the emergence of the radio broadcasting industry. Of key importance in this development were the inter-manufacturer licensing arrangements set up by the government during the war. These made it possible for competitive firms to pool their rights in the interest of advancing the state of the art.

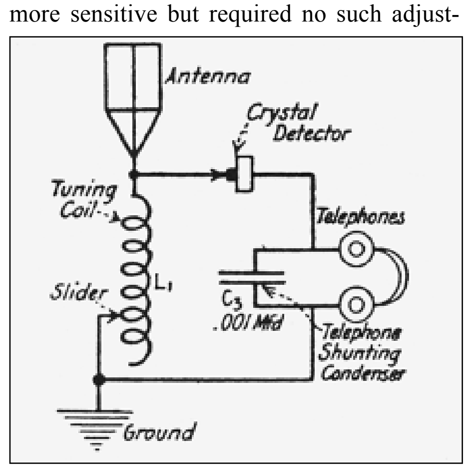
The dawn of radio broadcasting sparked a consumer radio boom that began in the early 1920s and continued until the onset of World War II. The equipment for broadcast listening was manufactured in such vast quantities that quite a lot of it has survived. These are the sets that we love, collect and restore today and, therefore, are the sets we'll be concentrating on in "Radio Restorations."

Crystal Sets

If asked to name the type of radio in widest use at the start of the broadcast radio boom, many of you would be likely to identify the crystal set. But, actually, advances (and cost reductions) in vacuum tube technology had made the crystal set all but obsolete by the end of World War I. It survived largely as a child's toy and in some of the simplest and least expensive consumer sets.

The crystal detector was one of the first examples of what we now call "semiconductor technology." Because the "crystal" (usually a crystal of Galena, or lead ore) was a much better conductor of electrical energy in one direction than the other (a property called rectification), it could remove the audio program being broadcast from its radio frequency "carrier," thus making it audible in a set of headphones.

But as it happens, the vacuum tubes of the era were far more reliable than any known crystal. As most folks know, operating a crystal detector meant constantly probing the surface of the crystal with a fine wire, known as a cat's whisker, to locate the ever-changing "sweet spot" at which reception would be loudest and clearest. Tubes were not only more sensitive but required no such adjust-



Schematic of a basic crystal set. The "Telephone Shunting Capacitor" allows detected audio signals to enter the headphones while keeping out residual radio frequency signals.

ment. Furthermore, they could amplify the radio signal as well as detect it.

If you decide that you have to have a crystal set for your collection, be prepared to spend some money for it. Very few serious crystal sets were made in the 1920s, and even fewer have survived. Though toy crystal sets were manufactured and sold even into the 1960s, these too seem to carry premium prices.

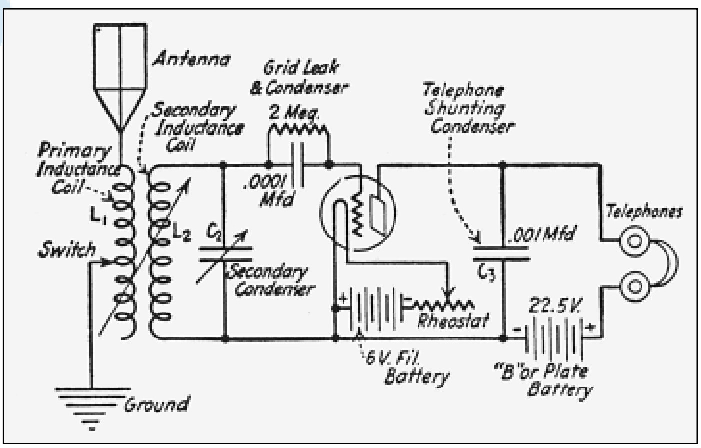
Vacuum Tube Detectors

The simplest form of vacuum detector you'll encounter in an early broadcast receiver is known as the grid leak detector. We have a lot of ground to cover in this overview, so we won't dwell on theory here. But the radio signal picked up by the antenna is impressed on the grid of a triode (3-element) tube through a coupling capacitor, and then appears in the tube's plate circuit in detected (rectified) form. The signal in the plate circuit is also amplified (made louder) by the action of the tube.

It is a characteristic of this type of circuit that the grid of the tube will become progressively more negatively charged, eventually preventing the tube from operating, unless a special circuit arrangement is made. This arrangement takes the form of a high-value resistor (the grid leak) connected across the coupling capacitor. The negative charge steadily drains off, through the "leak," into the positive side of the filament circuit.

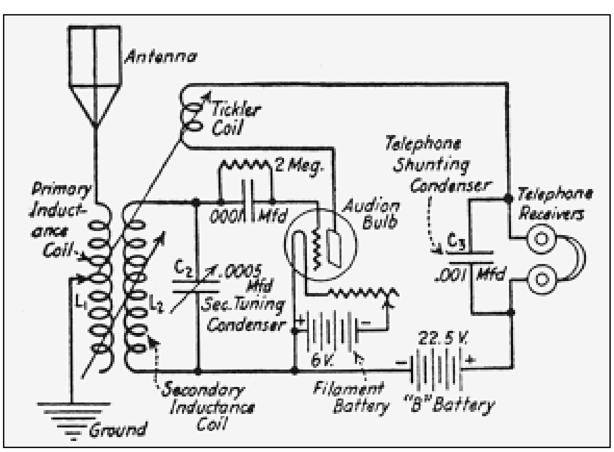
Though the grid leak detector circuit is an important one, you will rarely find it utilized in a commercially-made one- or two-tube set. Such a circuit just doesn't give enough bang for the buck in a set that size. It is not uncommon, however, to find grid leak detectors used in small home-made radios.

Small commercially-made broadcast radios of the early 1920s are apt to utilize a regenerative circuit. The regenerative design, developed by legendary radio inventor Edwin Armstrong, squeezed an amazing amount of performance out of a single tube. It is basically a grid-leak detector, but some of the signal appearing in the plate circuit of the tube was fed back into the grid circuit via a special tickler coil coupled to the main tuning coil. This feedback arrangement meant that the radio signal was amplified over and over again, resulting in tremendous gain.



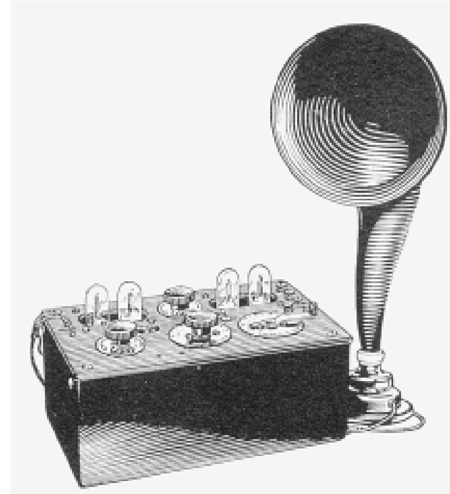
Simple grid leak detector circuit. The 2-megohm "leak" can be seen connected across the grid coupling capacitor.

To determine if your flea-market or garage-sale radio find is regenerative, first look at the controls and tubes. If it has a limited number of tubes, a control marked "regeneration" or "amplification" and only one tuning or "station selection" control, there isn't much doubt. The "regeneration" or "amplification" control typically operates a mechanical arrangement that changes the physical relationship between the tickler and main tuning coils.



Regenerative detector is basically a grid leak circuit. However, part of the signal in the plate circuit is fed back to the grid via the "tickler coil," resulting in tremendous amplification.

The tubes used in these sets were often dry-cell types (look for the types 11, 12 or 99). However, storage battery types such as the 01-A were also used. Some of the most ubiquitous small regenerative sets were made by Crosley (look for the 1-tube Model 50 and the 2-tube Model 51) and RCA (common are the 2-tube Radiola III and the 4-tube Radiola IIIA). In all cases, one tube is used as the regenerative detector and the others as stages of audio amplification.



RCA Radiola IIIA used one tube as a regenerative detector followed by three tubes functioning as audio amplifiers.

Next month, we'll continue our overview with radios using the TRF (tuned radio frequency) circuit.