RADIOACTIVITY-2026

Electronics Clinic

ORDERLY DIAGNOSTICS

AND UNUSUAL CIRCUITS TO TRAP YOU

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The kinds of things we need to check or repair:
Old vacuum-tube appliances:
Amplifiers
Phonographs
Tape Recorders
Radios
Television Receivers

Most of these we will assume must be plugged in to a power outlet in your home or shop. Therefore they should be at least made safe to plug in – safe for you when you want to operate the appliance in question, and safe for your home and family..

It would also be a lot more fun if the old appliance actually worked, too.

My daughter visited me about a month or two ago, and noticed this little wooden radio on a table in the study where my computer and books reside, and remarked that it looked cute, and asked “How does it play?”

And in answering her own question, which younger folks usually do when confronted with aged buggers like me, she looked for the nearest wall outlet so she could plug it in.

“Let me see it first.” I replied, and we looked it over, especially the back, where the power cord entered.

In this quick check, I noticed the power cord was frayed just as it entered the back panel of the radio. The rubber insulation was crumbly.

Sparton of Canada Model 5148

I was pondering how to introduce the topic of making these old appliances, whether radios,, phonos, TV sets, or amplifiers safe enough to have fun with again. Thank you, Lorrie.

The reason for the frayed power cord is the age of the original cord (punky rubber insulation) and the rather sharp edge of the rear panel fiber-board.

Straightforward procedure from here.

1. Remove the back panel
2. Panel has a glued-on loop antenna on inside surface. Mark wires and un-solder them; set back panel aside.
3. Remove control knobs on front and the two bottom screws that hold the chassis tray. (Very high class: chassis –in-a-tray!!) Remove four screws holding bottom tray on chassis.

On opening the back of the radio, the reason for its heavy mass is obvious ---A power transformer!!!

CHASSIS CONTENTS AND CONDITION CHECK:

1. Someone's been here already:
   A. Two 30uF 160-volt electrolytics found
   B. Power cord and other wires taped up.
   C. Two paper caps sweated and losing wax
   D. Ganged tuning cap rotor plates rubbing

Try separating power cord wires somewhat and use Variac power.

- No over-current episode
- Ran power to 120 V input- no issues except apparent shorts in ganged tuning capacitor.
- B+ level is 290 V d-c (but caps are 160-V !!)

Obvious step now is shut down and fix various replacement parts.

1. New power cord plus anchor to keep it still when the power cord is handled.
2. Replace both e-caps with 450-V types.
3. Replace both paper caps with modern film-epoxy 0.01 uF 400-V caps.
4. Clean volume control; check switch – OK.
5. Clean and lube ganged tuning cap sections.
6. Cut opening for power cord in back panel.

Test afterwards showed that 6SQ7 tube was defective. Diodes section OK, but triode section absolutely no Gm on tester.
Replaced tube – radio plays OK

Even though it's only AM.

—And there's nothing worth hearing there.

THIS WAS A “TYPICAL” RADIO REPAIR
Reviewed just to demonstrate an orderly method, which always starts with an external exam, then a diagnostic external/internal exam, to size up the total repair – is it worthwhile?

The scratchy tuning capacitor made it a closer call than most, and the former repair mistakes, like under-voltage electrolytic capacitors which could have failed or exploded and damaged the power transformer would have been fatal for the little Sparton-of-Canada.

But this is a hard-to-find make and model, at least here in the ‘states. It was probably somewhat expensive originally.

But now --- The task is to get down to the best way to evaluate the repair or restoration task on old test gear , appliances, and old radios.

Probably the first step is to estimate the value of the appliance, both in dollars and in usefulness , rarity, or value when restored to good looks and operating.

A separate, but also very useful issue , one which several of you have noted as a goal in these repair clinics , is to devise a way to evaluate just exactly HOW GOOD is the appliance when restored. If it's an audio amplifier, what is its level of performance? Or its distortion of the signal fed into its input? And over what frequency span does it meet this performance?

Examples follow:

One *Radio Age* reader wondered how to gauge the output power of radios or amplifiers, now that power meters are uncommon.

For both audio amplifiers and radios, what power output and fidelity of that output, relative to the input, do we expect? And actually get? And, how do we measure these things?

1. Back in the 30s and 40s, well-heeled radio technicians used power meters connected across the output transformer secondary , after disconnecting the speaker voice coil from these terminals.

2. Today, in the absence of wide-band power meters, we substitute a 4-to-8-ohm power resistor <u>in lieu</u> of the voice coil, and read the voltage developed across this resistor, calculating power by Ohm's law. $P=V^2/R$. This ignores any losses in the speaker or speakers. Modern speakers are relatively low in efficiency.

An alternative, which includes the speaker gains or losses, is to insert a 0.10-ohm power resistor in series with the speaker voice coil or in series with the two-wire cable that runs between the output transformer and the speaker(s). The a-c (signal) voltage across this resistor, when multiplied by 10, is the current, in amperes, going to the speaker(s).

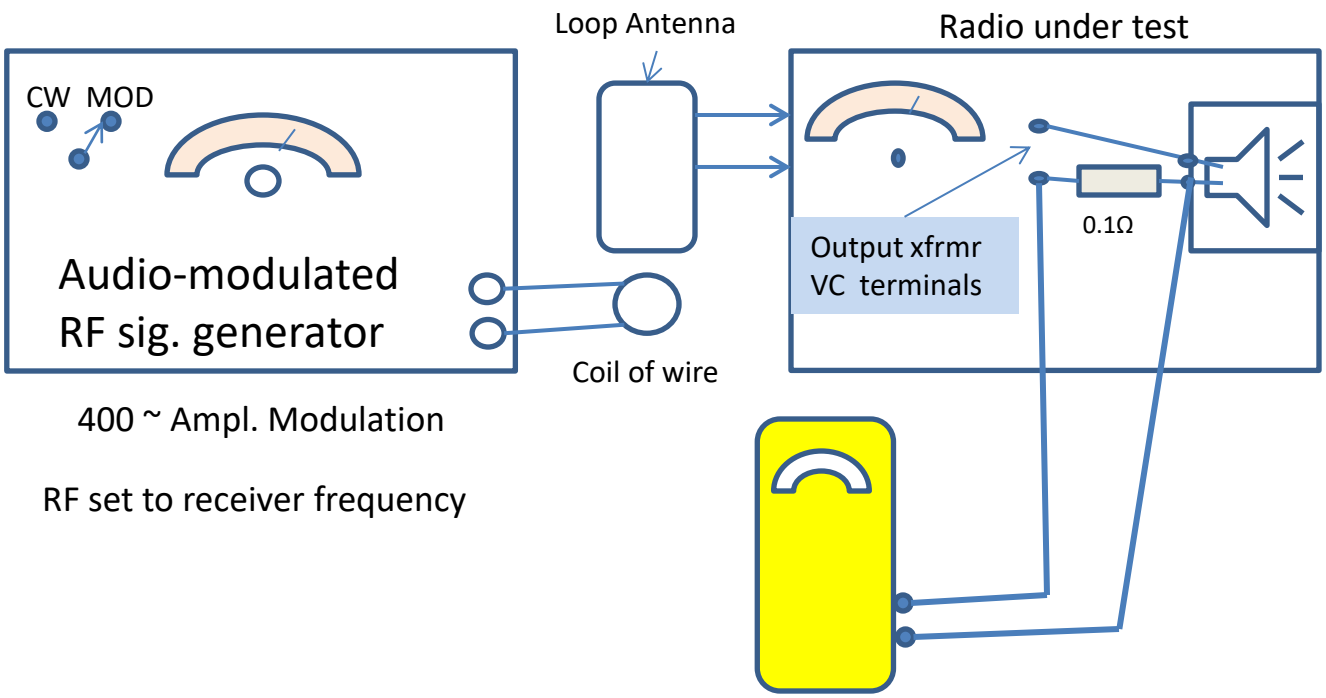
Again, use Ohm's Law to get the power

$$P = (\text{amps})^2 X\ 4$$

If you know your speakers exhibit 8 ohms or something other than 4 ohms, use that number as the multiplicand, above.

This is approximate, since the resistor you used also dissipates some additional power, and remember, the sound from the speaker(s) will be so deafening that it might attract the police.

Looking at that last method, circuit-wise, we see the overall test circuit looks like this:



And where do you get a 0.1-ohm resistor?

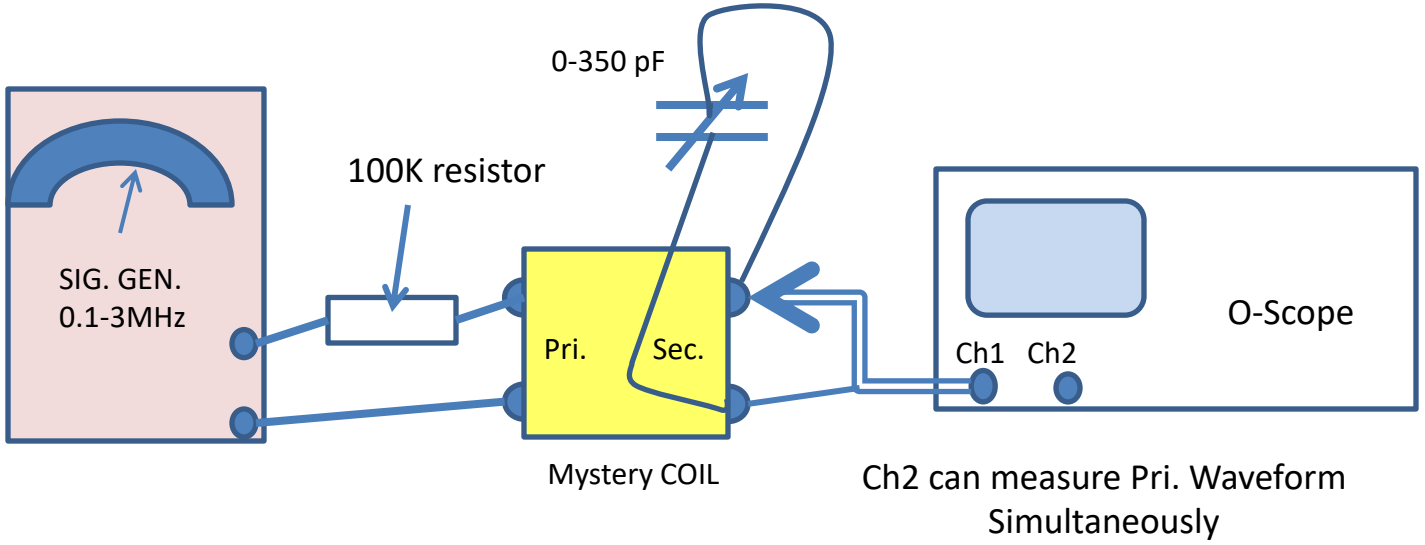
You can wire 10 each 1-ohm 2-watt resistors in parallel , or 22 each 2.2-ohm resistors in parallel, for example.

Use 1-watt or 2-watt resistors, depending on the expected power level of the output stage.

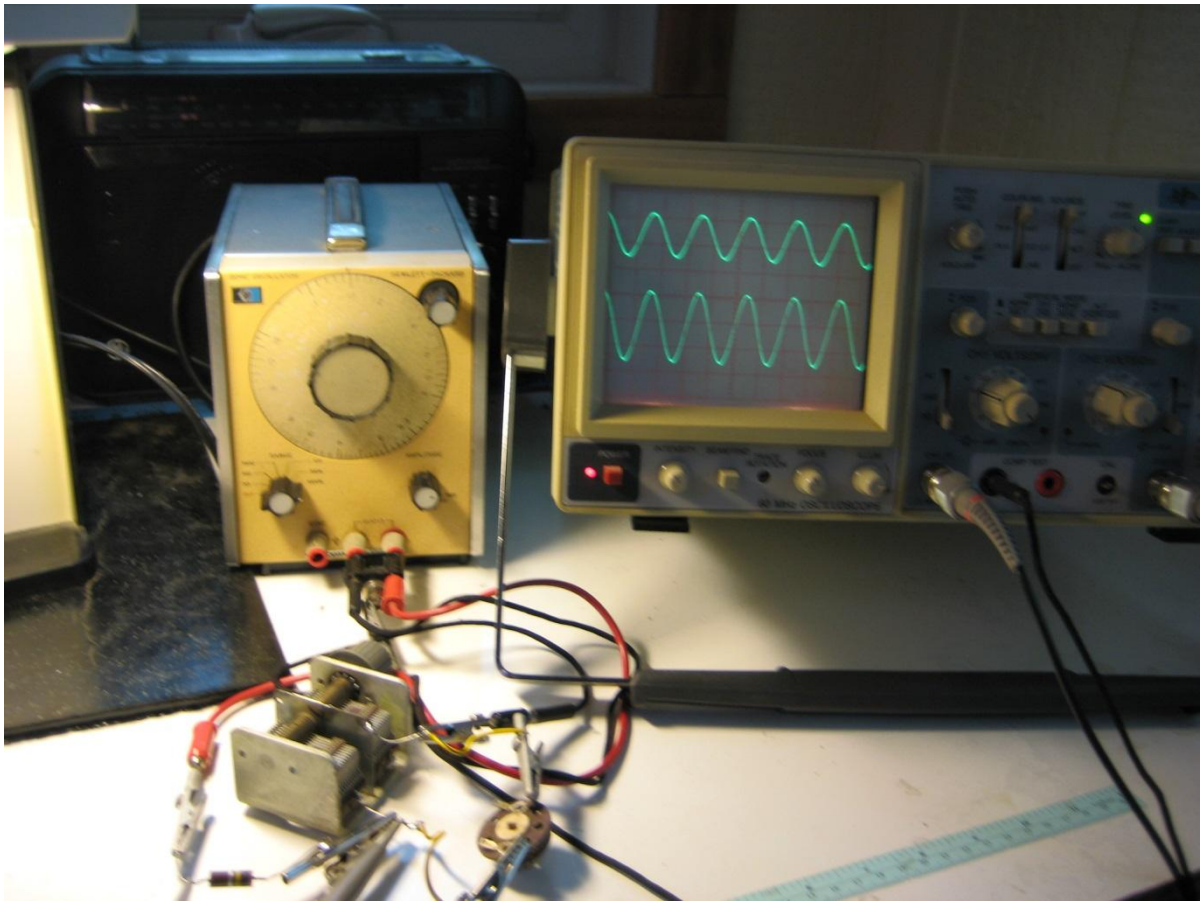
If the amplifier is rated at much higher power levels than, say, 25 watts, you might need higher-wattage resistors. And distant neighbors.

Another reader asked if there was a quick way to sort out all those Miller, Stanwyck, Aladdin, and unlabeled coil assemblies that are in our junk boxes when what we need is a functional antenna-to-6SA7 transformer or a local oscillator coil. Here is just the thing:

You'll need an oscilloscope, a signal generator, and a couple example ganged tuning capacitors, with their knob. The test setup is below:



Test setup for finding the inductance of an unknown coil from junk box; 320pF capacitor set at nearly full capacitance.



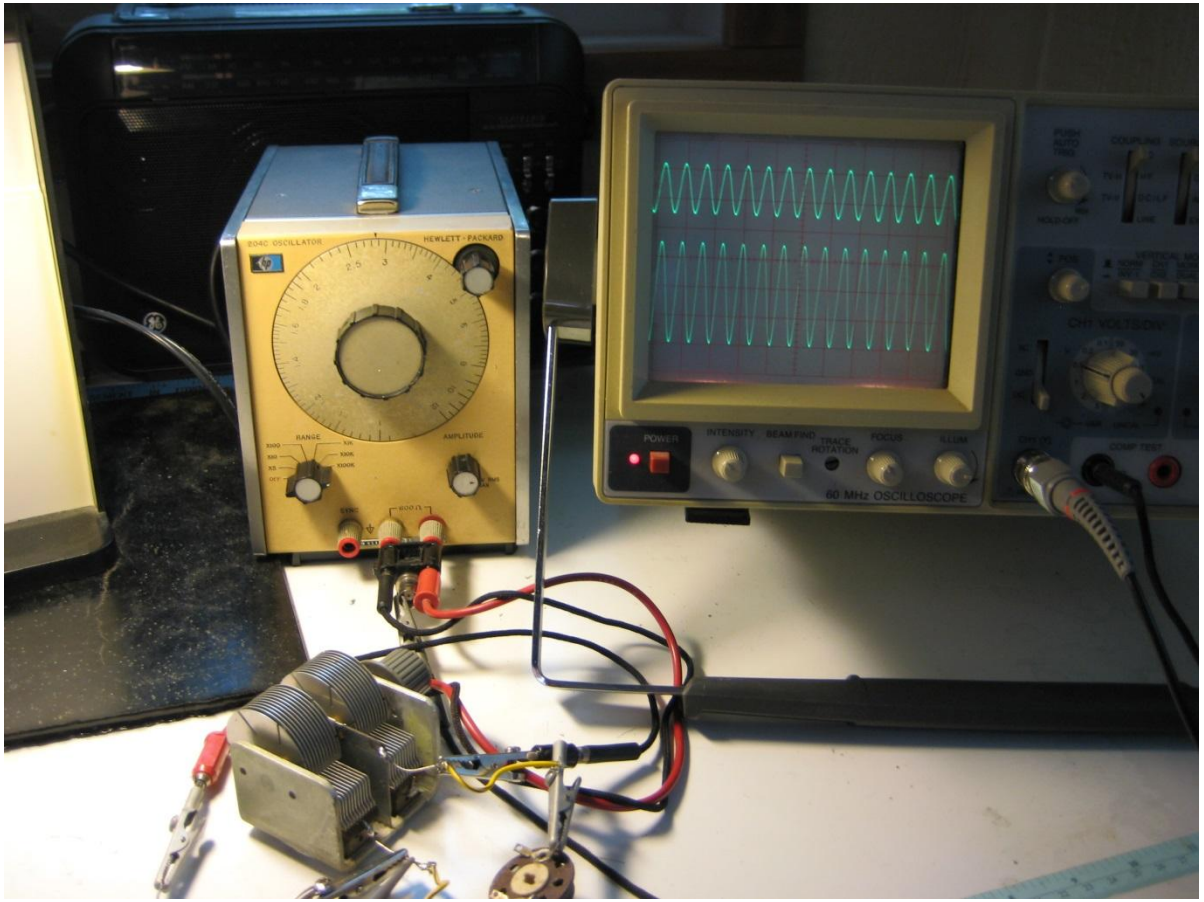
Upper trace:
Sig Gen output

Lower trace:
Sig at top of coil and Var. cap.
At nearly full cap.
(~300 pF)

Sig Gen set at Resonance
~110KHz

ERGO:
Coil is ~7.1 mH

Here's the same mystery coil with the parallel-wired variable capacitor set to a nearly wide open (low capacity) setting. Estimated net stray capacity is 30 pF.



Now the resonant frequency appears to be about 300 kHz

At this frequency, with 30 pF stray capacitance, the inductance of the mystery coil is, again about 7.1 mH.

Check and double-check.

Where did we get the value of the inductance? The Mallory Encyclopedia's Inductance-Capacitance-Frequency Charts .

And that Mallory Encyclopedia also shows about 150 schematics of various ways volume and tone controls were implemented in the radios and amplifiers of the past, and in the comprehensive listing of practically all the radios and amplifiers of that time (1929-1945) they show the tube complements and power supply filter arrangements. This is a valuable asset when that radio-of-unknown-maker shows up.

The MAARC Radio Restoration course of 1995 used the Mallory-Yaxley Encyclopedia as a reference of value for diagnosing troubles in audio equipment, radios, and record-players. In the course, we also covered cabinet restoration procedures, both as of the time period the equipment was manufactured and as of the present time.

Today, the best resource for details about a radio or other electronics appliance might be *Radiomuseum.com.*

That is important, since some of the formerly available sources have become much harder to work with. Here we are referring to *Nostalgia air*, for example.

The MAARC course included a review of the test equipment recommended for the collector who wants to restore electronics gear.
The review also gave hints and suggestions for getting the most out of your test equipment.

The third suggestion for subject matter for this clinic wanted to see how one sorts out a complex radio or audio console that seems “different” from the norm.

Like a Communications Receiver
…or a Scott Receiver
…or a Transmitter

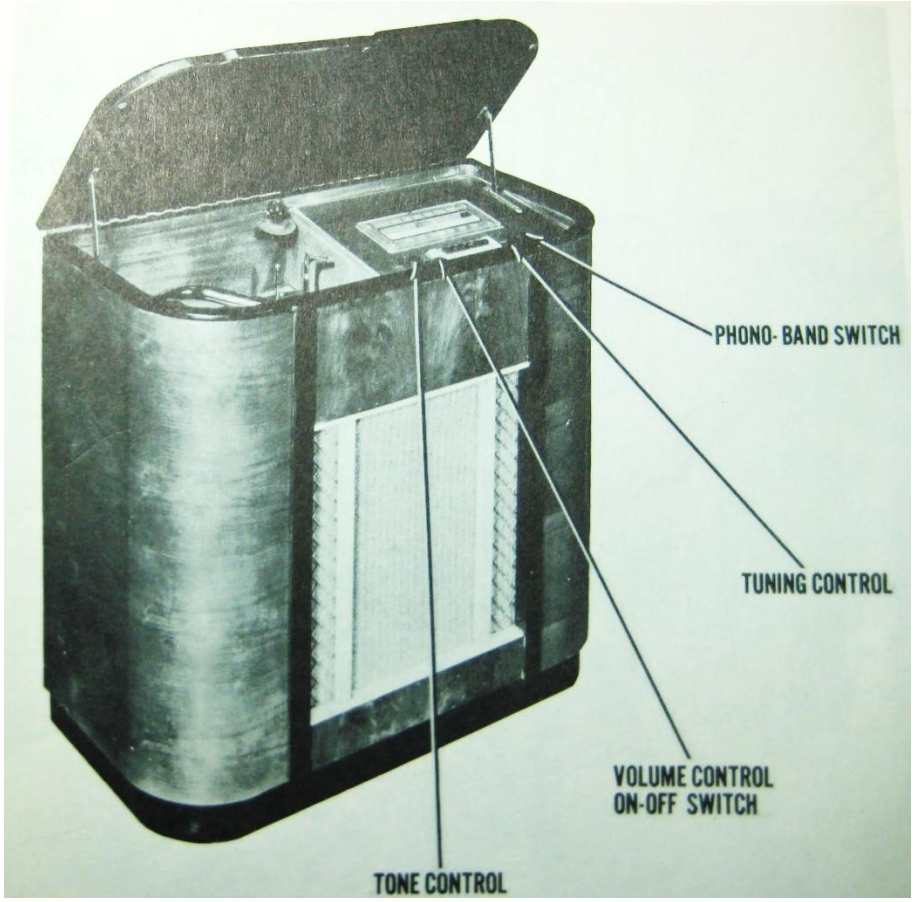
…Or like the Farnsworth console I ran across in my early repair trade

Let’s take a look at that type radio, using SAM’s Photofacts, which we would have killed for back in the 1950s.

This Farnsworth GK-102 was in a posh mansion of a home in Shaker Heights, Ohio, and it didn't play at all…. "Just quit one evening, but the damned AM still plays." This was going to be an unusual radio to analyze… 10 tubes… push-pull 6V6s …push-button tuning…. Oh! one of the tubes is a miniature….6AG5, often found in radar receivers in the 60 MHz IF amplifiers…. And one of the metal octals was a weird one, a 6SB7Y, and although the radio had been switched ON for a while with the home-owner fiddling with the controls and grumbling, that 6SB7Y was cold, so I thought the problem might be there. The set was set for FM, and the owner said he never listens to AM, except for the morning weather reports.

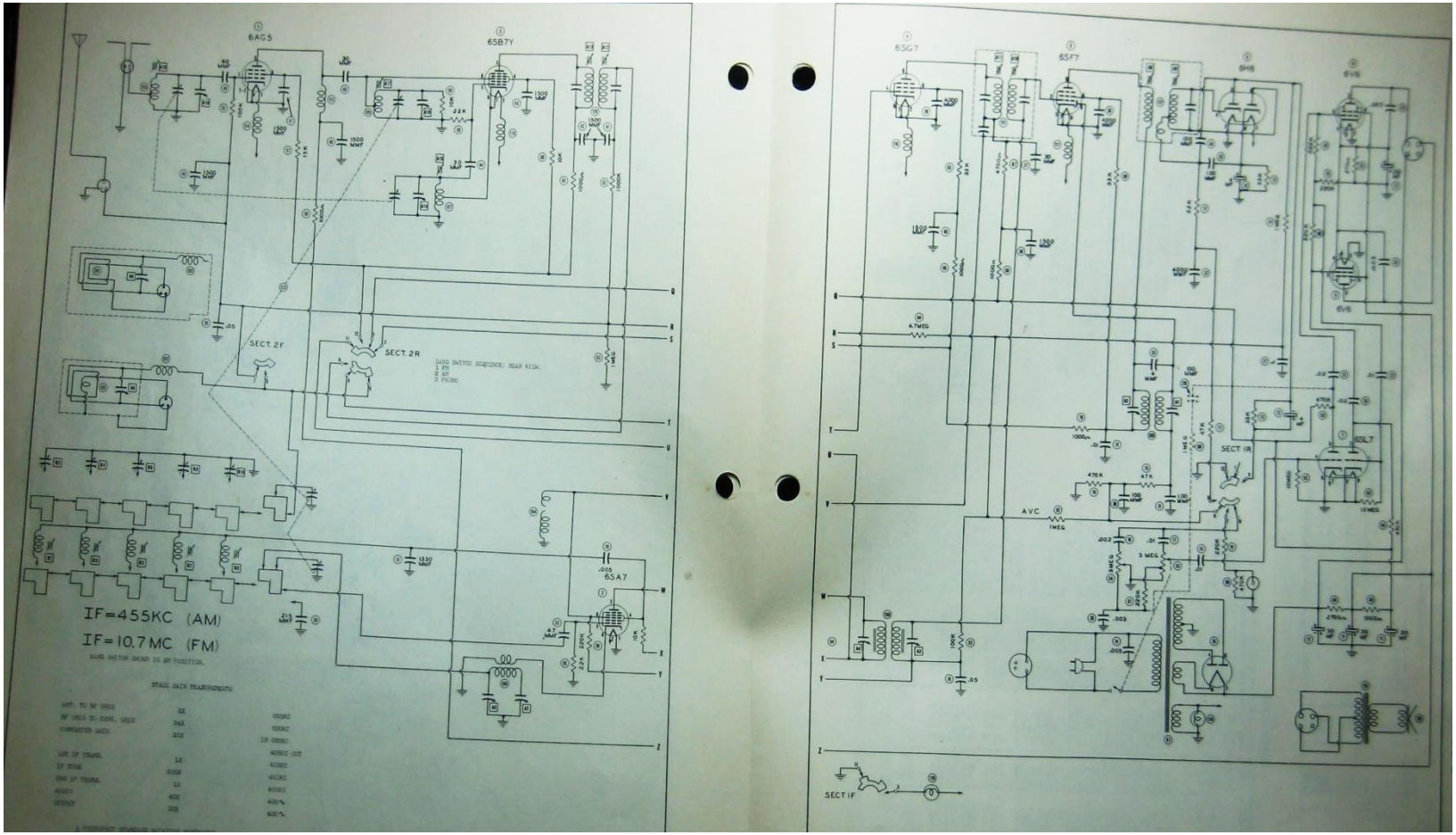
We did not have schematics of radios at the time, and the owner said it was only five months old. I told him the metal tube with the yellow colored base was cold, and likely not good, so I verified that by the obvious test, check the heater pins for continuity…and I had to assume the heater pins were 2 and 7, like so many octals…. No continuity there. But I checked pins 7 and 8 as well…. Also an open circuit. So he needed a 6SB7Y, a tube I rarely saw.

I had to pay 4 dollars for a replacement tube, so I collected 5 bucks total from Mr. Spring, the home-owner, and left him enjoying some classical music as I packed up and departed.



The Farnsworth GK102 AM/FM deluxe radio/phonograph

It wasn't until two weeks ago that I found a schematic for that Farnsworth GK-102, and it had surprises.



That Farnsworth GK102 had these tube assignments:

1. FM RF amp……..6AG5 sharp cutoff pentode
2. FM 1st Detector…….6SB7Y VHF pentagrid
3. FM 1st IF amp/lim...6SG7 sharp cutoff pentode
4. FM 2nd IF amp…… 6SF7 remote cutoff pentode
5. FM Discriminator… 6H6 duo-diode
6. AM RF amp……..6SG7 without AVC
7. AM 1st Detector……6SA7 AM pentagrid
8. AM IF amp……6SF7 with AVC
9. AM 2nd Detector….6SF7diode section
10. Audio AM/FM……6SL7, p-p 6V6s

These sorts of radios commonly promote e-mails from restorers;
"Too many tubes doing different jobs in AM than in FM."

One of the handiest documents you can have at your fingertips in Electronics repair and restoration is the Mallory-Yaxley Radio Service Encyclopedia. It was issued at several times, each one more complete that the earlier versions.

MAARC's repair/restoration course that I put together in the early days of MAARC featured a hand-out notebook with many pages of data taken from the FIFTH edition of Mallory-Yaxley. I have one of those notebooks here and some of might want to get copies of sections of it.

Take a look, and e-mail me if you think you could use some of that data.

A syllabus notebook for the 1995 MAARC repair/restoration course can be passed around for inspection, and if portions are considered useful, you can e-mail Ed Lyon and get copies or additional (or more detailed) information on the subjects discussed in the syllabus.
Use: LYON@FRED.NET

QUESTIONS?
Shout or use the mike.