SoundWaves

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VRPS Fall 2019

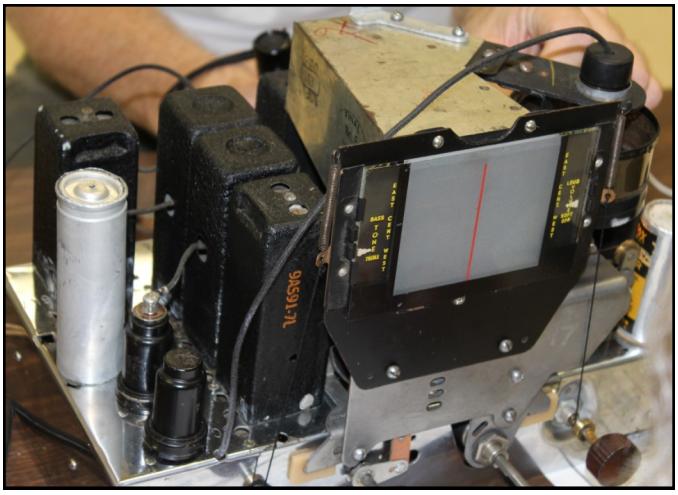
From the President

The temps here in north Texas have not yet caught up to the calendar as we approach the end of summer. But, I am confident that this too shall pass. My wife and I had a great summer traveling to D.C. and then on to the Chicago area to witness the Antique Radio Club of Illinois annual Radiofest. I can report that there was a great turnout and a record auction at this event. The recent growth in attendance and auction results has to bode well for the radio hobby as a whole. It was great to see several of the VRPS members make the trek north this year.

Of course, locally, we continue to have a great turnout at our monthly meetings. We are constantly seeing 30 to 40 members each month. I would suggest that this is a reflection of two factors. One, we have good meeting topics as well as presenters who spend time putting together programs. The other factor is that our core membership has a desire to learn more about our hobby.
Another topic of interest to me this time of year is our annual convention. In November we will be celebrating our 45th year…that is quite a milestone and will be celebrated appropriately. I know I am prejudice, but there is little doubt that our convention is tops when it comes to attendance, variety, and just plain fun. I look forward to seeing each of you at the Comfort Inn and Suites in Plano this November.

On a final note, several folks have asked about the status of my new auction building in Granbury. Well, after 9 months of effort the final parking lot was poured and all is ready. B and I are excited that our first auction is slated for the end of September. Watch my website and email blasts for details. I hope to see you there. Good hunting!

--Jim



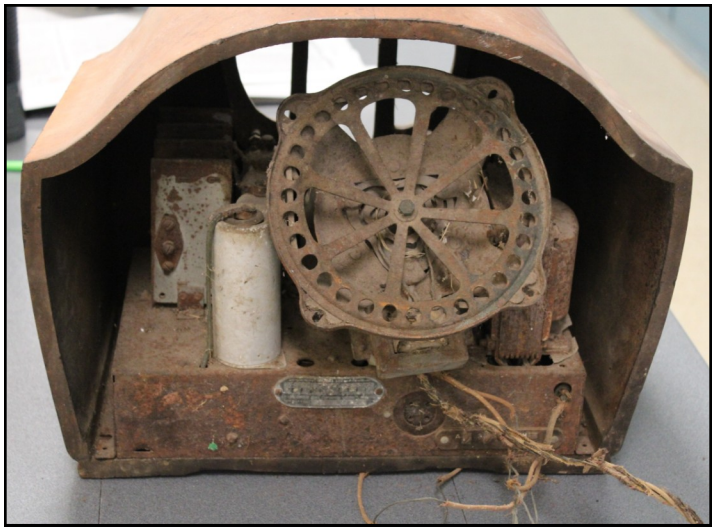
Notes from the July 20th Repair Session

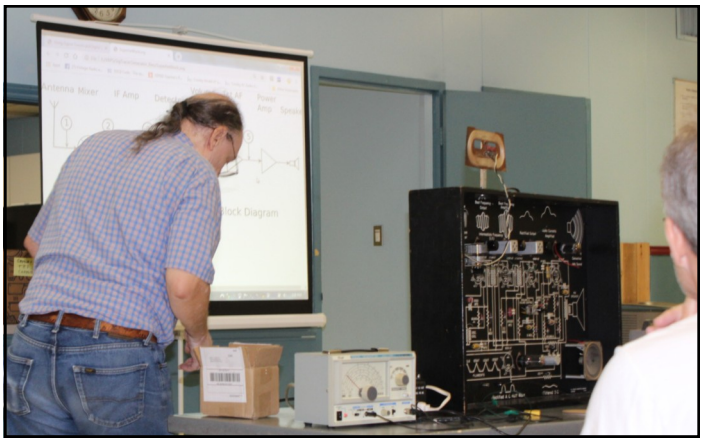
Our annual July Repair Session was held at the Senter East meeting place. This facility is very desirable for our sessions, because of its large amount of space and the availability of good tables and many electrical power outlets. There were a number of good "challenges" for us to work on with good success either in getting a set going or identifying what next steps the owner needs to follow. One challenge was a very popular high-end multi -band radio that seemed to need alignment. It would pick up only a couple of stations on the broadcast band.

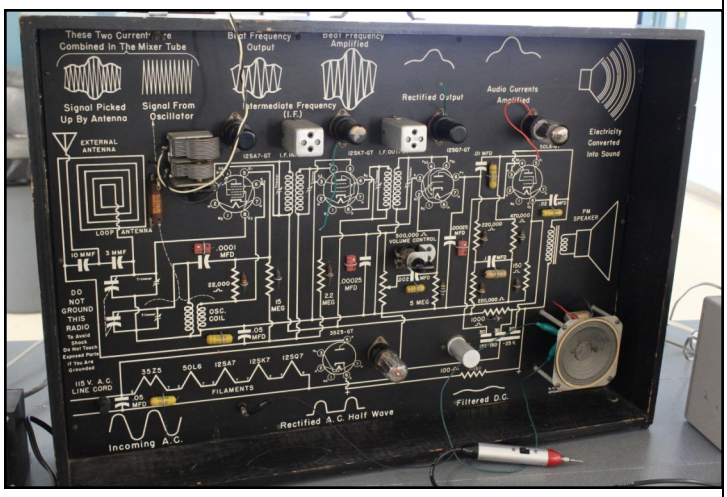
Most of the time, old radios play well without re-alignment of the tuned circuits. Sometimes, however, the adjustments have been changed in an attempt to make the radio play - despite the fact the real problem is unrelated to alignment. Once the real problem is corrected, the radio still doesn't play. Then the problem is twofold – a signal generator will be required to align the radio, and the owner will need to need to be familiar with the alignment process. This can be daunting for a complex multi-band super-heterodyne radio. The author assisted in the process of checking and correcting the alignment, which was found to be seriously bad, especially in the I.F. stages. Correcting this problem did not help the situation, however, leaving suspicion pointed at the band selection switch or the broadcast band local oscillator coil. It was surprising to find that the short-wave bands worked by connecting the antenna to one of the building aluminum window frames. Our working time for the day ran out, so now we hope to hear of some real success from the radio's owner.

[*See Radio Detective Mystery this issue, for one such story*.]

Bill McKeown







Notes from the August 17th Meeting

Club President Jim Sargent opened our meeting, which was held at the Senter East building. He reminded us that our September 21st swap meet will be held at the Irving Garden and Arts building. Also, he suggested we get our reservations made for our annual Convention. Next, Larry Lindsey presented a "SMITR" award certificate from a previous meeting (won by the author) and posed the new question for the group. The question was "who invented and produced an automobile ignition system used in the 1930's?" Jim Sargent knew that it was Atwater Kent - who made auto parts before he made radios.

Next, Mike McCarty began his presentation on the use of a signal tracer for troubleshooting radio problems. Prior to our meeting, Mike had posted, on the club website, a very detailed and illustrated description of the process – titled "Using Signal Tracers and Signal Generators for Trouble Shooting". It can be accessed by clicking on the "Technical Info" button located on the VRPS.org home page. His setup for the presentation included a signal generator, a Heathkit model T-4 signal tracer, a multimeter, an isolation transformer, and also a large "training board". The board is a large vertical panel with all of the parts for a 5-tube AC/DC radio (octal-based tubes) mounted to it and spread out over a background schematic diagram. It was made originally by a radio manufacturer for use in training radio repairman. It has been very useful for presentations like this one. Mike used it to create test cases for troubleshooting, by disconnecting parts within the various RF, IF and audio stages of the radio on the panel. He set up the signal generator to act as an RF source, modulated with a 400Hz audio tone – feeding into the RF or antenna input of the radio. With the radio working OK, the tone could be heard from the radio speaker. Step by step he traced the signal from one stage to the next, moving the probe switch to its "audio" position when looking for a signal after the detector stage. He pointed out that each stage of the radio should exhibit amplification of the signal – except for the detector - calling for a reduction of the gain of the signal tracer as you move from one stage to the next. This can help identify a weak (but not dead) stage.

By disconnecting parts he showed how the signal tracer can isolate a dead stage. He also showed how the Heathkit signal tracer can be passively (unplugged and turned off) used as a substitute for the speaker in a radio, with or without an output transformer. As a safety precaution, Mike pointed out that one of the output transformer primary test jacks has a connection to the Heathkit Model T-4 B+ voltage when the power switch is in the ON position. So you should unplug the unit and turn the power switch to the OFF position while this feature is being used. There are two jacks at the top that let you

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The Case of the One Station Wonder
By Mike McCarty

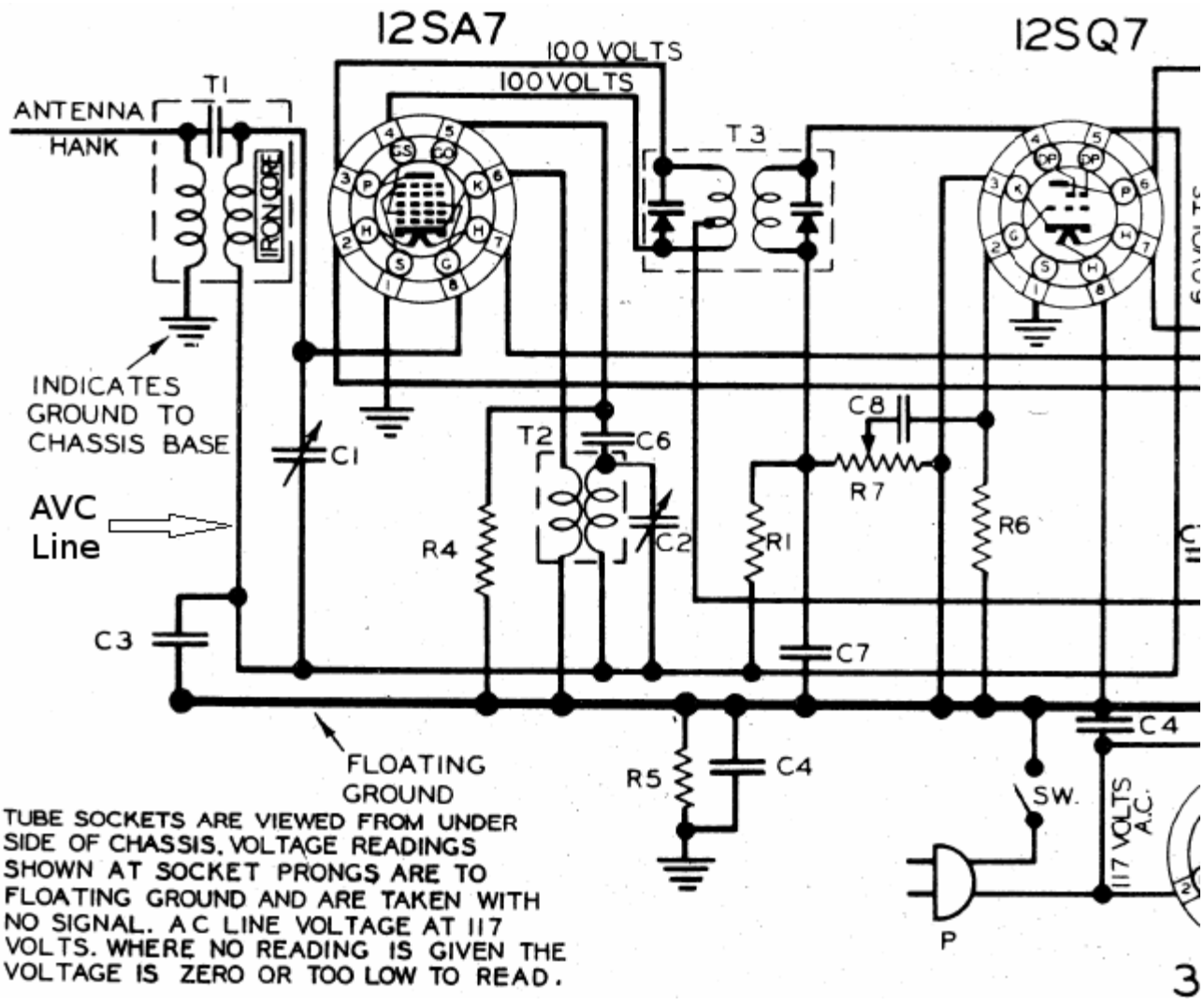
At the July 2019 Repair Session, a club member brought in the chassis of an Arvin Model 444 for me to look at. I asked him what the symptoms were, and he answered that he had recapped it, and replaced the out of tolerance resistors, but it only gets one station. For clarification I asked whether this one station was always received regardless of tuning, all across the band, and he replied that it had to be tuned in, but it's the only one the radio could receive. I tentatively classified this as "very low sensitivity, cause unknown". He then added that he had replaced the tuning condenser. I updated my estimate to "possibly caused by extreme tracking error or incompatible tuning condenser", and asked where he got the tuning condenser. He replied that he got it from an identical junker chassis, and I reduced the likelihood of the tuning condenser being the cause, but kept it in the back of my mind.

Step one was to collect more information, starting with verifying the symptoms reported by the owner. Since this is an AC/DC (though not hot chassis) set, I connected up my isolation transformer and dim bulb, and plugged the radio chassis into it. I put a 100 Watt lamp into the dim bulb apparatus rather than my usual 40 Watt when doing a first power on, since the set had already been recapped, and checked by the owner. I set the dim bulb to limit, and turned on the radio.

At first, all seemed normal. The bulb ran up to a dull yellow, then back down to a barely discernible dull red. After a few moments, I flipped the dim bulb to full power, and let the set warm up for a bit. Since the chassis was out and had no knobs, I used a paper towel to turn the tuning shaft to prevent shorting out the signal, and verified that indeed, only one station could be received, and it had to be tuned in. Since it was a very strong local station, I tentatively assigned the proximate cause to be lack of sensitivity, and began to ponder what might be a deeper cause.

This radio has an antenna transformer, T1 in the schematic. [*Schematic on page 5*] The primary is connected to the antenna on one end, and to the chassis on the other end. The chassis is isolated from the power line through capacitor C4 in the schematic. It was very common in the past for this capacitor to fail shorted. If the antenna then came into contact with any ground, then the antenna transformer primary would be connected directly from the power line to ground. If that side of the power line happened to be "hot", then the primary of the antenna transformer would be burnt out, causing a tremendous loss of sensitivity, since the antenna would effectively be removed from the circuit. This was so common a situation in the past, that replacement primaries for antenna transformers were available in various sizes in order to repair this fault. I turned off the dim bulb, waited a moment for any voltages to dissipate, and then a quick check with an ohm meter showed that the primary was intact, shooting down that guess.

By habit, I set the dim bulb back to limit and



turned it on. After the set warmed up for a bit, I tuned around, and the little set received stations all over the dial! Hmm. I tuned to a station and listened for a bit, and it came in clearly and without distortion. The radio seemed to be operating normally. I set the dim bulb back to full power expecting the reception to get a little better, and as I listened, to my amazement, the station gradually faded away into silence! What on EARTH!? Just to make sure, I set the dim bulb back to limit, and the station gradually came back. It seemed that the exact voltages present in the radio could bring on or eliminate the problem. This pointed to a problem with what's called bias.

For tubes to operate properly, they need certain fixed voltages applied to their elements. Especially important are the voltages on the grid and plate (relative to the cathode, that is). These fixed voltages establish the no signal, also called Quiescent, or Q point of the tube on its characteristic curves. The static voltage on the grid is called the bias. Small variations in the Q point constitute the signal. When smallish changes in operating voltages result in huge operating characteristic changes, this points to a problem with the Q point, or bias on the grid of some tube.

I set the dim bulb back to full power, and after the station faded away, I turned the volume control up to full and put my finger on the "hot" terminal thereof, using my body as a signal injector. I got a nice loud buzz from the speaker, indicating that the audio stages were not the problem. Since this radio

has no IF amplifier, the problem had to be in the converter stage.

There is circuitry in the radio whose purpose is to set the bias point of the converter in order to reduce sensitivity, inappropriately called the Automatic Volume Control (AVC). That would be a possible cause for lack of sensitivity if it were activated some how. I checked the AVC level by measuring the DC voltage on the end of R1 away from the volume control (R7), and found it was more than NEGATIVE seven volts, even when tuned between stations! The AVC voltage varies from pretty close to 0 VDC when tuned off station to perhaps -7 VDC when tuned to a very strong local station. This set's sensitivity was being reduced to the very minimum possible by the AVC circuitry all the time. What was the source of this voltage?

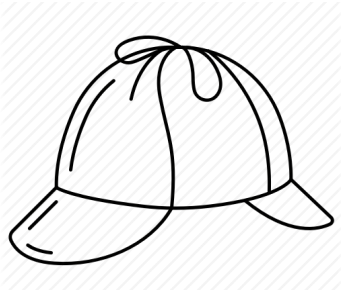
In an AC/DC set like this, the only way to develop a negative voltage like that is through rectification of a signal, since there is no transformer. The AVC circuitry does this by rectifying the carrier signal present on the secondary of the last IF transformer. What signal could be present in the IF transformer when the radio was not tuned to a station? It's possible that an IF amplifier could oscillate at the IF, and I've seen that happen, but this radio has no IF amplifier. The local oscillator deliberately oscillates, but not at a frequency that could get through the IF transformer. However, the converter tube has gain at the IF, and it's possible that it could oscillate at the IF. There is an old adage amongst circuit design engineers that amplifiers oscillate, and oscillators don't.

How was I going to figure out whether the converter were oscillating? I needed an oscilloscope, but I didn't bring one. I turned off the dim bulb so as not to leave high voltage unattended and went looking. A little asking turned up a solid state 'scope had been brought in by Billy Smith! Hurrah!

With 'scope in hand, I went back to the little radio and turned it on. The oscilloscope verified that the IF signal was clean. There was no sign of any oscillation, at any frequency. Another guess down the tubes. And yet, the AVC voltage was -7.5 VDC!

WHAT WAS GOING ON IN THIS SET?

Time for some imagination and letting ideas collide. That voltage, -7.5 VDC, is suspiciously close to that normally on the local oscillator grid, grid one of the 12SA7. That voltage is developed by the converter tube itself, by rectifying its own signal. Maybe the local oscillator is driving the AVC somehow? I tuned the set to the bottom end of the band and measured the local oscillator grid and AVC voltages. They were the same. I tuned up a little higher, and noted that both voltages changed slightly, and both were still the same. I tuned a little higher, and both voltages changed by another few tenths of a volt, and both were the same. Hmm. It appears that the oscillator grid might be driving the AVC voltage. To test this hypothesis, I powered down the set, and unsoldered the AVC filter resistor R1 from the AVC line. After powering up again, the voltage on the free end of the resistor was 0 VDC, and the AVC line was still -7 VDC or so. This confirmed that the voltage was coming from the converter tube. I powered down and resoldered the resistor. It's time to put on the thinking cap.



One possibility is that, during recapping and replacing out of tolerance resistors, the owner had inadvertently changed the connections. I checked the circuitry against the schematic, and verified that all components surrounding the converter tube

were correct. Another guess shot down.

It was time to put on a different thinking cap. I measured the resistance between the oscillator grid (pin 5 of the 12SA7) and the AVC line. It was about 7 Meg. Looking at the schematic, I can trace from the oscillator grid, down through the grid leak (R4, 22,000 ohms) to ground, over and up through volume control (R7, 2 Meg), through the AVC filter resistor (R1, 4.7 Meg). OK, that looks normal. So, WHAT'S THE PROBLEM?

There has to be a sneak path somewhere, I just can't see it.

The tube might have a short, but the owner claims that all tubes have been tested good, and besides, grid one would short to grid 2 which is the screen and has about +100 VDC, not grid 3. OK, back to the schematic. Start with the AVC line, and look at each component connected to it, and see if there is a way to get to the oscillator grid through that component. Starting at the left, we have the antenna transformer secondary and tuning condenser C1. They don't go to the oscillator grid. The AVC filter capacitor C3 goes to ground, so it's not the problem. Next, we have the oscillator coil (T2) secondary and tuning condenser C2, which do go up that way, but they are isolated by the feedback condenser C6, a 50 pF mica capacitor. Mica capacitors, by conventional wisdom, don't go bad, except for a few which get water in them, corrode, and become open. I'm looking for a short, not an open. Besides, if that cap were open, the oscillator wouldn't work. The only other components connected are the AVC filter resistor which goes to the volume control, and the AVC delay diode in the 12SQ7. I'm stumped. There HAS to be a DC path to the oscillator grid.

Sherlock Holmes in "The Sign of Four" to Dr. Watson: "How often have I said to you that when you have eliminated the impossible, whatever remains, *however improbable*, must be the truth?"

I have never, ever, seen a leaky mica capacitor. I've never even heard of one. However, I have come to the conclusion that I'm looking at a leaky mica capacitor, C6. It has to be. The AVC line is a very high impedance point, and even a small amount of leakage would overwhelm the intended drive from the volume control. I didn't bring any replacement capacitors suitable, and asking around didn't find any. This was so intriguing, that I decided to do the repair myself, rather than leave it up to the owner. I asked for and got permission to take the radio back with me to my work bench.

Later that afternoon, I went to stock and pulled out a suitable replacement, NP0 ceramic capacitor. This capacitor is in a critical frequency determining circuit, and needs to be either a mica or an NP0 ceramic. Morally convinced I had to be right, but still somewhat incredulous, and wondering if my diagnosis actually were correct, I unsoldered the original on one end, and tacked in the replacement. I hooked up my isolation transformer and dim bulb, and powered up the radio. After checking the bulb, I switched to full power, and the radio received stations all across the dial! I powered down the radio, finished removing the original leaky(!) mica, and did a proper job of soldering in the replacement. I powered on again with the dim bulb, then full power, and listened to the radio for about a half hour to verify that the repair was permanent. A leaky mica capacitor! Well, live and learn.

Case Solved!

Continued from page 3

drive the internal speaker voice coil directly. On this particular signal tracer, the "NOISE" feature places a DC voltage (with limited current) on the probe which you can apply to a tuning capacitor and look for sparking between the plates as you rotate it, allowing you to see any shorting and bend the plates as necessary.

Author's Note: If the radio "front end" is already working, a radio station signal can be used instead of an RF signal generator and only the signal tracer used to find a dead stage. The "eye" tube can be used as an indicator for alignment purposes, connected to the detector output. If a speaker is dead on a newly acquired radio, a signal tracer can be used to do an overall "health check" on it, perhaps while waiting for a new part.

Bill McKeown

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MONTHLY MEETING PROGRAMS 2018

NOTE: Programs will be held at various locations in Irving, Texas. Make note of the location as they may change from time to time. Senter East, 228 Chamberlain St.; or Garden and Arts, 906 S Senter Rd. Maps are located on the WEB site, www.VRPS.org EVENTS page. Programs start at 2pm. unless otherwise noted. Call us on the cell tellie if you get lost: 972-898-7251 or 972-742-8085.

- **OCTOBER 19 - SIGNAL TRACING REVISITED ; SHOW & TELL - SENTER EAST BUILDING - 2 PM**
- **NOVEMBER 15, 16, 17 - ANNUAL CONVENTION; PLANO, TX**
- **DECEMBER 14 - GARDEN ARTS BUILDING ANNUAL CHRISTMAS PARTY 1--5 PM**

Programs are subject to change, contingent on scheduling conflicts. As always, your suggestions for programs/ content are welcome. If the programs do not fit your needs and you want something different, let me know. I need volunteers to organize other programs, so consider presenting a program yourself. Call anytime or send an email: **Larry Lindsey email: pipilindsey@tx.rr.com telephone: 817-312-8761.**.