FEEDBACK

THE OFFICIAL NEWSLETTER OF THE

GEORGIAN BAY AMATEUR RADIO CLUB INC.

FEBRUARY 1996

Sponsoring

VE3OSR FM REPEATER	146.940-	Mhz	BARROW BAY
VE3OST FM REPEATER	145.290-	Mhz	OWEN SOUND
VE3GBT FM REPEATER	146.895-	Mhz	MARKDALE
VE3IJD PACKET BBS	145.630	Mhz	KEADY

REGULAR EVENTS

GBARC MEETINGS:

FOURTH TUESDAY OF EACH MONTH

Billy Bishop Regional Airport 7:30 P.M.

BREAKFAST MEETINGS:

SECOND AND LAST SATURDAY OF EACH MONTH, Rockford Esso

GBARC INFORMATION:

FOR MORE INFORMATION CONTACT:

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MINUTES of JANUARY MEETING 1996

Brad, VE3RHJ, opened the January meeting. Twenty-two members attended. The minutes of the last meeting were amended to include the status on the Hobby Market with Port Elgin, Collingwood and Kincardine participating. Another amendment was to announce that Collingwood would be hosting the Winter Special Olympics.

/A3KMS, Ken, said that no work would be done on the repeater until Spring. Bob, VE3X0X, has two UHF radios that he will donate to the Club to help improve the repeater system. A report will be made next month regarding the link up-grade.

Gene, VE3IJD, said that the packet BBS is still up and running okay despite the fire.

Dave, VA3DSI, reported that a speaker from Camp Borden who was to speak to the Club regarding communications was unable to attend the meeting as planned.

VE3XKM, Steve, reported there were eight students in the recent Amateur course with only one person dropping out.

It was mentioned that the Bruce area ARES co-ordinator, Jim, VE30VV, will be stepping down. Mike, VE3SYT, said that on March 18th at 7:30 P.M. there will be a guest speaker, Pierre Mainville, who will be speaking to us about ARES.

John, VA3JRF, said there will be no changes of the Thursday night net.

Tom, VE3NEM, said that our bank balance is $1,076.75. A cheque that we sent out to the CNIB came back because of a wrong address. It will be sent out to the local office. He also reported that the Club has secured a Post Office box in Owen Sound for $73.30.

Bob, VE3X0X, said the Kincardine group will give word next month whether they will be giving financial help to the Hobby Market. VE3SYT, Mike, said the Collingwood group would give a page for E-mail if our Club needs a home page.

In new business, Bill, VE3HMZ, and Ross, VE3BZC, are setting up a fund to help Gene and Randi get back on their feet after the fire. Also, on February 9th, at the Keady arena there will be a benefit dance for Gene and Randi from 9:00 P.M. to 1 A.M. Everyone was urged to come and have fun.

Field Day is in June and Steve, VE3XKM, will be organizing it. Stan, SWL, had a car accident and the Club has sent out a "Get Well" card. We are glad to report that he is coming along nicely. Ian, VE3HXX, was in the hospital at the time of the meeting. He also received a "Get Well" card from the Club. He is now out of the hospital.

Bob, VE3XOX, recently spoke to the Golden K Club about Amateur Radio and was presented with an Appreciation Certificate. Bob, VE3XOX, won the 50-50 draw. Minutes by Richard, VE3WUD.

MESSAGE FROM THE PRESIDENT --- Brad VE3RHJ

LESSONS FROM SANTA CLAUS

It may surprise you to hear that the 1995 Santa Claus Parade was my first experience with a Public Service event. Ever. GBARC is only the third amateur radio club I've belonged to, and the first to take any part in community activites. So I've been curious for a few years about the Owen Sound Santa Claus Parade, and last December I took the plunge. I don't know if the lessons I learned will apply to other events, but I thought I'd share them anyway.

Lesson #1: Plan Ahead. The members from GBARC arrived at the event as a pack of radio operators -- ready, willing, and clueless. We thought the Kiwanis club had a communications plan, and they thought we did. As a result we had to improvise on the spot, and begin dispatching hams "down the street" in search of Kiwanis parade guards. We also had to choose 146.52 simplex on the spur of the moment.

Lesson #2: Organize by location. When our hams connected up with Kiwanis staff, they called in who they were with. Before long we realized it was more important to know WHERE each operator was. Even then, I'm sure we could have been better spread out.

Lesson #3: Have a net controller. I -- the complete newcomer -- found myself attached to the parade coordinator, AND acting as net control. These two jobs are not compatible! The net controller needs a warm place to sit still, with a clipboard and no distractions. He also needs a good location and a powerful rig -- the guys at the parade ends often couldn't hear me.

Lesson #4: Put experienced operators in key positions. Half of our operators this year were first-timers. We were lucky that Gene VE3IJD took the parade start, and that Aubrey VE3TUQ was in the right place to handle the ambulance call. (We would have been luckier if I had known what to do in MY position!)

Lesson #5: Have relief operators. By the end of the event, I was almost in pain from bladder pressure. We had extra operators, but no one knew who was busy and who could be dispatched to a new position. (That's why the net controller needs a clipboard.)

Lesson #6: Use an earpiece. My arm got tired holding my HT to my ear for three hours! Even then, I often couldn't hear over the noise, and I often had to drop my hand to do something. A speaker/mic clipped near my ear would have been an improvement; an earpiece better still. Next year I'm going all out: I've seen an ad for an HT earpiece with boom microphone, which will be ideal.

Lesson #7 (and lesson #1 for next year): Have early contact with the event organizers. We could have been much more useful (and much more calm) if we'd met with the Kiwanis people earlier, to discuss their needs and our capabilities. We were supposed to provide communications only, but somehow we got dragged into helping marshal the parade. Meetings during the planning stages would have made our responsibilities much clearer.

If it sounds like the 1995 parade was a disaster, well, it wasn't. I was filled with pride to see how the members of GBARC sorted themselves out ad hoc, made themselves useful, and responded to the unexpected (like the appearance of an ambulance!). After a brief initial confusion, we became a disciplined, professional communications team. Most of all, it was fun! See you there next year!

- Brad VE3RHJ

P.S. Remember that we have election of officers in May (nominations in April). The nominating committee may be calling you soon; please consider running for a club office. GBARC runs on volunteers!

P.P.S. Our hobby market is June 1st! We need you to help in one of two ways: either volunteer to work the event, or buy a table. Clean out the shack and turn some of that surplus into cash! And be sure to tell your friends! Ham, CB, SWL, electronics, or computer hobbyist -- all will find something of interest.

TOUCH LAMP RFI CURED

◊ KL7CC's article on tracking down "creepy crawlers" generated by touch lamps[4] brought to mind a similar situation in my home. We have two touch-controlled lamps that copied 3.5-MHz CW (150-watt level), made rotten ac crawlers on 3.5 MHz and sometimes even oscillated—with one lamp turning on the other and vice versa! Consumer junk!

The lamps we own have no manufacturer's name on them, but do have a PC board that contains the sensing and lamp-control circuit. Not being bashful, I reverse engineered a schematic and found that replacing a 100-Ω resistor on the board with a 2.7-mH choke cured these problems (see Fig 2). There are probably many types of lamp controllers on the market, but if a particular lamp uses the circuit shown in Fig 2, the 2.7-mH fix should be effective.

By the way, one of the lamps had the lamp-socket shell connected to the *hot* side of the ac line! I fixed that!—*Dave Hallock, WØSS, 605 Grand Ave, Marion, IA 52302*

[4]J. Wiley, "Touch-Control-Lamp RFI," Technical Correspondence, *QST*, Feb 1993, pp 53-54.

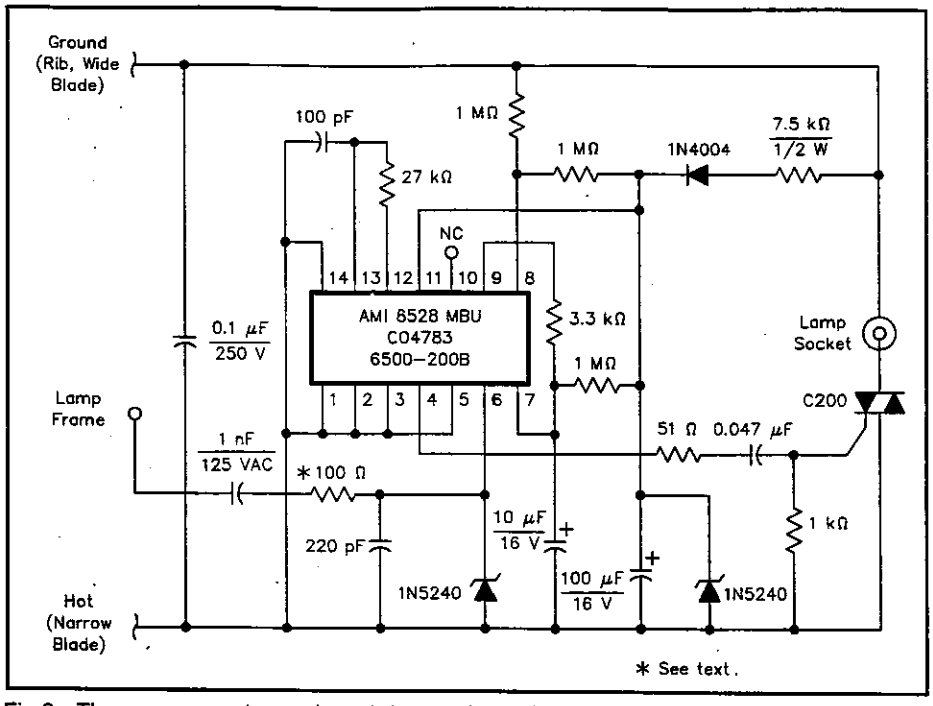

Fig 2—The reverse-engineered touch-lamp schematic provided by Dave Hallock.

Winter is the time when you try to keep your home as warm as it was in summer when you complained about it.

WOEFUL TALE

The boy wanted $100 very badly, and his mother told him to pray to God for it. He prayed and prayed for two weeks, but nothing turned up. Then he decided that perhaps he should write God a letter requesting the $100.

When the Midland Canada Post office got the letter addressed to God, they opened it up and decided to send it to the Prime Minister. The Prime Minister was so touched and amused that he instructed his secretary to send the little boy a cheque for $5. He thought this would appear to be a lot of money to a little boy.

The boy was delighted with the $5, and sat down to write a thank-you letter to God, which read as follows:

Dear God: Thank you very much for sending me the money. I noticed that you had to send it through Ottawa. As usual, those bastards deducted $95.

ANTIQUE RADIO REPAIR -- A SHORT COURSE

INTRODUCTION: It really doesn't require a great deal of test equipment or technical savvy to restore an antique radio to top notch condition. You should however have some knowledge of the fundamentals of electronics (how tubes work to amplify a signal, the differences between a TRF receiver and a superhet, how diodes rectify, how power supplies work, etc, etc...) in order to fully utilize the following material. If you need assistance in getting a better grasp of the these fundamentals, your library may have a few books on the subject. Now as far as test equipment is concerned, you should have three items: a good 20,000 (or greater) ohms/volt VOM, a signal tracer with a demodulator probe, and a schematic diagram of the radio receiver you are working on. The VOM can be purchased from Radio Shack, the signal tracer can be purchased in kit form from Heath Company. By the way, the manual that comes with the signal tracer will give basic troubleshooting procedures. One other item will be helpful at times, and this is an RF signal generator which is also available from the Heath Company in kit form, but you can buy this later after you become more proficient at troubleshooting. Most experts also mandate using an isolation transformer for safety, but later I will suggest an alternative.

The first step in troubleshooting a dead (no sound from speaker) radio is to see if the tubes light up. As you can see from an (older) textbook, radio's with a power transformer have their filaments wired in parallel and are supplied with AC voltage from a winding on the power transformer. Therefore suppose the radio you are working on is dead, has a power transformer and one of the tubes is not lit. You will probably find the tube not lit to have an open filament, which can be verified by removing the tube from the socket and measuring its filament resistance with the lowest range of your ohmmeter. If you don't get a reading, the filament is open and you have found the trouble. Now suppose that all tubes were not lit. In this case the problem is caused by either a faulty AC line plug, an open line cord, a defective fuse in the primary of the power transformer (if one exists), a defective on/off switch, or a bad winding on the power transformer. By the way, power transformers rarely go bad. ALWAYS BE ON THE LOOKOUT FOR BAD SOLDER JOINTS !!!!!!!! Now lets suppose the radio you are working on is dead (no sound from the speaker), and has no power transformer. Your textbook will show that radio's without a power transformer wire the filaments in series with the on/off switch, line cord and line plug. As you can see, an open in any one of the above will cause the filaments not to be lit. Again, you can use your ohmmeter, but an open tube filament is probably the cause of failure.

What do you do if you find a bad RESISTIVE LINE CORD? Replace it with a regular line cord, but install a resistor in series with the tube filaments. How do you calculate the resistor value? First look up the filament voltage for each tube in a tube manual. The resistor is equal to 120 minus the sum of the filament voltages, divided by the filament current (of one tube only) in amperes. Now wasn't that easy! Its wattage is equal to 120 minus the sum of the filament voltages, times itself, and divided by the resistance value you just calculated. FOLLOW YOUR WIRING DIAGRAM!!!!!!

Lets talk about another easily corrected problem. When you turn the tuning knob, the frequency pointer remains stationary. At this point, you must remove the chassis from the cabinet by removing the screws from the bottom and back of the cabinet. It will also be necessary to pull off the front knobs. Be very careful, I can't give explicit directions as each model is different. As you can see, a drive mechanism moves the frequency pointer as the tuning knob is turned. But look....the dial cord which goes from pulley to pulley is broken! Replace that cord with a new dial cord, but work on the radio with the tuning capacitor in the closed position. This will prevent damaging the capacitor and will insure that the frequency pointer will point to 550 KC on the dial when the tuning capacitor is closed, which is the way it's supposed to be. But before you replace the chassis and speaker, it would be a good idea to see if the radio plays. READ AND HEED THE NEXT SENTENCE!!! Whenever working on a transformerless radio, you must insert the line plug in the wall

socket so that no AC voltage can be measured on your VOM between the metal chassis and a good ground. If you don't get 0 volts AC, reverse the line plug. This procedure is done with the ON/OFF switch "on", and must be done each time you work on AC/DC radios, so that you don't receive a jolt each time you touch the chassis! .....REMEMBER, A SHOCK CAN BE LETHAL !!!!!

As you know from your studies, the power supply supplies the needed DC voltages to the tubes, without which the radio will not play. Even a low supply voltage may causes problems. The power supply output (or B+) can become deficient in (3) ways. Either it's missing, is low in value, or has an excess AC ripple content. Missing B+ is caused by either a defective rectifier tube or an open filter resister or choke coil. Tube failure can be verified by substitution with a good tube, and the open filter can be verified with your ohmmeter. A low B+ can also be caused by a bad rectifier tube. Excess AC ripple manifests itself as HUM in the speaker, and is caused by a defective electrolytic capacitor in the filter network. The electrolytic capacitor is the big CAN you see on top of the chassis. If you cannot find a CAN type replacement, install a terminal strip on the underside of the chassis and relocate the wiring from the bad capacitor to the strip adding new tubular (with identical ratings) electrolytic capacitors. For esthetic reasons leave the defective CAN on the chassis.

Now let's review the signal tracer. It's nothing more than a high gain amplifier with a demodulator probe. As you probably know, the electronic circuitry between the antenna and speaker of an AM radio amplify and modify the received transmitted signal. Each stage has an input and an output, and we use the tracer to methodically trace the development of the signal through the defective radio. For example, suppose we have on the bench a radio with no output from the speaker even with the volume control fully clockwise. We also observe that all filaments are lit. Now lets use the signal tracer to find the defective circuitry! The first thing we must do is set the frequency pointer of the defective radio to a known local station. We can double check the pointer accuracy by touching the CONTROL GRID of the RF AMPLIFIER tube with the demodulator probe. WE NOW HEAR THE LOCAL RADIO STATION from the signal tacer speaker! Next we touch the PLATE of the RF AMPLIFIER tube, the grid and plate of the CONVERTER tube, and the control grid and plate of both IF AMPLIFIER tubes. At each location we hear the local station, so we shift the probe to the control grid of the FIRST AUDIO AMPLIFIER tube. Again we hear the signal, but when we touch the plate we hear nothing. We have found the defective stage! The next thing we do is substitute another good tube for the AUDIO AMPLIFIER tube, but this doesn't help, so we get out our trusty old VOM and start taking DC voltage readings. We check the plate and find o volts DC. The diagram says it should be 65V, so we turn off power, unplug the line cord, and start taking resistance readings of the plate circuitry. WE FOUND IT! The load resister is open, it should read 7500 ohms. With an open load resister, the plate receives no voltage, so the tube stopped amplifying. We replace it and the radio plays....end of story.

Restoring an old radio also means returning the cabinet to its original condition. Tuning knobs and dial plate should also look original. You can find needed parts by advertising in ANTIQUE RADIO CLASSIFIED, or by writing to its advertisers. All this may sound like hard work, but the rewards make it all worthwhile.

SERVICING TIPS

1. When working on live circuitry, do so with extreme care. A shock probably will not be fatal, but your response from it may cause you to jerk and cause some other problem such as knocking over and damaging the radio your working on, or upsetting the soldering iron.

2. Keep your soldering iron in an approved holder when HOT.

3. A 100 watt iron or gun is adequate for servicing antique radios. Get one with a small sharp tip. RADIOSHACK can supply the necessary hand tools.

4. Become proficient at soldering before working on a radio, as poor soldering techniques may introduce more defects in the radio your working on.

5. Don't change parts on a whim. Do so only after careful investigation. Unnecessary probing and movement of parts may introduce additional defects.

6. Train yourself to see trouble. Always be on the lookout for bad solder joints and overheated parts. They may be the cause of trouble.

7. Before turning the radio "on", make sure the correct tube type is in the correct tube socket. It's also a good idea tocheck the tubes on a tube tester before appling AC.

8. KEEP A FIRE EXTINGUISHER IN YOUR WORK AREA !

The following is a list of some of the more popular tubes used in antique radios. REMEMBER ... WHEN REMOVING A TUBE FROM ITS SOCKET, DO SO VERY CAREFULLY as the tube probably has lost rigidity due to aging !

TUBE		FILAMEN		PIN NUMBER								
TYPE	FUNCTION	volts	amps	FIL-CT	K	P	G1	G2	G3	G4	G5	G6
01A	Amplifier	5.0	.25	1-4		2	3					
2A3	Power Amplifier	2.5	2.50	1-4		2	3					
2A5	Power Amplifier	2.5	1.75	1-6	5	2	4	3	5			
2A7	Converter	2.5	.80	1-7	6	2	5	4	3	C	3	
2B7	Amplifier	2.5	.80	1-7	6	2	C	3	6			
	Detector					4,5						
5U4	Rectifier	5.0	3.00	2-8		4,6						
5V4	Rectifier	5.0	2.00	28	8	4,6						
5Y3	Rectifier	5.0	2.00	2-8		4,6						
5Z3	Rectifier	5.0	3.00	1-4		2,3						
6A7/6A7S	Converter	6.3	.30	1-7	6	2	5	4	3	C	3	
6A8	Converter	6.3	.30	2-7	8	3	5	6	4	C	4	
6B7	Amplifier	6.3	.30	1-7	6	2	C	3	6			
	Detector					4,5						
6C5	Amplifier	6.3	.30	2-7	8	3	5					
6C6	Amplifier	6.3	.30	1-6	5	2	C	3	4			
6C7	Amplifier	6.3	.30	1-7	6	2	C					
	Detector					4,5						
6D6	Amplifier	6.3	.30	1-6	5	2	C	3	4			
6F6	Power Amplifier	6.3	.70	2-7	8	3	5	4	8			
6F7/6F7S	Amplifier	6.3	.30	1-7	6	2	C	3	6			
	Amplifier					4	5					
6G6	Power Amplifier	6.3	.15	2-7	8	3	5	4	8			
6H6	Rectifier	6.3	.30	2-7	8	5						
	Rectifier				4	3						
6J5	Amplifier	6.3	.30	2-7	8	3	5					
6K6	Power Amplifier	6.3	.40	2-7	8	3	5	4	8			
6K7	Amplifier	6.3	.30	2-7	8	3	C	4	5			
6K8	Mixer	6.3	.30	2-7	8	3	5	4	C	4		
	Oscillator					6	5					
6Q7	Amplifier	6.3	.30	2-7	8	3	C					
	Detector					4,5						
6SA7	Converter	6.3	.30	2-7	6	3	5	4	8	4	6	
6SC7	Amplifier	6.3	.30	7-8	6	5	4					
	Amplifer					2	3					
6SK7	Amplifier	6.3	.30	2-7	5	8	4	6	3			
6SQ7	Amplifier	6.3	.30	7-8	3	6	2					
	Detector					4,5						
6U5/6G5	Indicator	6.3	.30	1-6	5	2	3	(target=pin 4)				
6U6	Power Amplifier	6.3	.75	2-7	8	3	5	4	8			
6U7	Amplifier	6.3	.30	2-7	8	3	C	4	5			
6V6	Power Amplifier	6.3	.45	2-7	8	3	5	4	8			
6V7	Amplifier	6.3	.30	2-7	8	3	C					
	Detector					4,5						

6W5	Rectifier	6.3	.90	2-7	8	3,5						
6W6	Power Amplifier	6.3	1.25	2-7	8	3	5	4	8			
6X5	Rectifier	6.3	.60	2-7	8	3,5						
6ZY5	Rectifier	6.3	.30	2-7	8	3,5						
7A4	Amplifier	6.3	.30	1-8	7	2	6					
7B5	Power Amplifier	6.3	.75	1-8	7	2	6	3	7			
7C6	Rectifier	6.3	.15	1-8	2	3						
	Rectifier				7	6						
7A7	Amplifier	6.3	.30	1-8	7	2	6	3	4			
7A8	Converter	6.3	.15	1-8	7	2	4	3	5	6	5	7
7B4	Amplifier	6.3	.30	1-8	7	2	6					
7B5	Power Amplifier	6.3	.40	1-8	7	2	6	3	7			
7C5	Power Amplifier	6.3	.45	1-8	7	2	6	3	7			
7C6	Amplifier	6.3	.15	1-8	7	2	3					
	Detector					5,6						
7E6	Amplifier	6.3	.30	1-8	7	2	3					
	Detector					5,6						

TUBE		FILAMENT			PIN NUMBER							
TYPE	FUNCTION	volts	amps	FIL-CT	K	P	G1	G2	G3	G4	G5	G6
7F7	Amplifier	6.3	.30	1-8	2	3	4					
	Amplifier				7	6	5					
7G7/1232	Amplifier	6.3	.45	1-8	7	2	6	3	4			
7H7	Amplifier	6.3	.30	1-8	7	2	6	3	4			
7L7	Amplifier	6.3	.30	1-8	7	2	6	3	4			
7N7	Amplifier	6.3	.60	1-8	2	3	4					
	Amplifier				7	6	5					
7Q7	Converter	6.3	.30	1-8	7	2	4	3	6	3	5	
7R7	Amplifier	6.3	.30	1-8	7	2	6	5	7			
	Detector					3,4						
7S7	Mixer	6.3	.30	1-8	7	2	6	5	4	5	7	
	Oscillator					3	4					
7W7	Amplifier	6.3	.45	1-8	7	2	6	3	4			
7Y4	Rectifier	6.3	.50	1-8	7	3,6						
12SA7	Converter	12.6	.15	2-7	6	3	5	4	8	4	1	
12SK7	Amplifier	12.6	.15	2-7	5	8	4	6	3			
12SQ7	Amplifier	12.6	.15	7-8	3	6	2					
	Detector					4,5						
15	RF Amplifier	2.0	.22	1-5	4	2	C	3	4			
19	Power Amplifier	2.0	.26	1-6		2	3					
	Power Amplifier					5	4					
24A/24S	RF Amp-Detector	2.5	1.75	1-5	4	2	C	3				
25A6	Power Amplifier	25.0	.30	2-7	8	3	5	4	8			
25L6	Power Amplifier	25.0	.30	2-7	8	3	5	4	8			
25Z5	Rectifier	25.0	.30	1-6	4	5						
	Rectifier				3	2						
26	Amplifier	1.5	1.05	1-4		2	3					
27/27S	Det-Amplifier	2.5	1.75	1-5	4	2	3					
30	Det-Amplifier	2.0	.06	1-4		2	3					
33	Power Amplifier	2.0	.26	1-5		2	3	4	5			
35/35S	Amplifier	2.5	1.75	1-5	4	2	C	3				
35L6	Power Amplifier	35.0	.15	2-7	8	3	5	4	8			
35Z5	Rectifier	35.0	.15	2-7 3	8	5						
36	RF Amp-Detector	6.3	.30	1-5	4	2	C	3				
39/44	AF-RF Amplifier	6.3	.30	1-5	4	2	C	3	4			
41	Power Amplifier	6.3	.41	1-6	5	2	4	3	5			
42	Power Amplifier	6.3	.65	1-6	5	2	4	3	5			
43	Power Amplifier	25.0	.30	1-6	5	2	4	3	5			
45	Power Amplifier	2.5	1.50	1-4		2	3					
46	Power Amplifier	2.5	1.75	1-5		2	3	4				
47	Power Amplifier	2.5	1.75	1-5		2	3	4				
50C6	Power Amplifier	50.0	.15	2-7	8	3	5	4	8			
50L6	Power Amplifier	50.0	.15	2-7	8	3	5	4	8			
55	Amplifier	2.5	1.00	1-6	5	2	C					

	Detector						3,4			
56/56S	Det-Amplifier	2.5	1.00	1-5	4	2	3			
57/57S	Det-Amplifier	2.5	1.00	1-6	5	2	C	3	4	
58/58S	Amplifier	2.5	1.00	1-6	5	2	C	3	4	
71A	Power Amplifier	5.0	.25	1-4		2	3			
75	Amplifier	6.3	.30	1-6	5	2	C			
	Detector					3,4				
76	Det-Ampler	6.3	.30	1-5	4	2	3			
78	Amplifier	6.3	.30	1-6	5	2	C	3	4	
80	Rectifier	5.0	2.00	1-4		2,3				
83	Rectifier	5.0	3.00	1-4		2,3				
85	Amplifier	6.3	.30	1-6	5	2	C			
	Detector					3,4				
V99	Det-Amplifier	3.3	.063	2-4		3	1			
X99	Det-Amplifier	3.3	.063	1-4		2	3			

FIL = filament, CT = center tap, K = cathode, P = plate, G# = grid #, C = cap

RMA COLOR CODE FOR POWER TRANSFORMERS

1. Primary leads-black. If tapped: common-black; tap-black & yellow striped; finish-black & red striped.
2. High-voltage plate winding-red. Center tap-red & yellow striped.
3. Rectifier filament winding-yellow. Center tap-yellow & blue striped.
4. Filament winding #1-green. Center tap-green & yellow striped.
5. Filament winding #2-brown. Center tap-brown & yellow striped.
6. Filament winding #3-gray. Center tap-gray & yellow striped.

RMA COLOR CODE FOR AUDIO-FREQUENCY TRANSFORMERS

Blue-Plate lead of the primary.
Red-B+ lead.
Green & Black-for center-tapped push-pull operation.
Green-Grid lead to secondary.
Black-Grid return (this applies whether the secondary is plain or center-tapped).

RMA COLOR CODE FOR INTERMEDIATE-FREQUENCY TRANSFORMERS

Blue-Plate (primary) lead.
Red-B+ (primary) lead.
Green-Grid (secondary) lead.
Black-Grid or AVC (secondary) lead.

NOTE: Aging my cause a color change to occur. Also, a different color code may have been used by the builder.

RMA COLOR CODE FOR SPEAKER FIELD COILS

Black & red striped-start
& red striped-finish

NOTE: The center-tap (if any) will be Yellow gray & red striped.

VACUUM TUBE NUMBERING SYSTEM

All vacuum tube pins are numbered according to one easily remembered rule. WHEN VIEWING A TUBE SOCKET FROM THE CHASSIS UNDERSIDE, PINS ARE NUMBERED IN THE CLOCKWISE DIRECTION STARTING FROM THE KEY.

VACUUM TUBE SUBTITUTION

Many of the vacuum tubes used in antique radios can be replaced with another tube type (such as a 5Z3 for a type 80) without any rewiring, but a substitution manual must be consulted first. Your public library or antique radio supplier will certainly have them. If you expect to do much serviceing, you should purchase your own copy!

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