



# The FLASH!



Dedicated to the Preservation and Education of Wireless, Radio, Television and Associated Equipment

Volume 15, Issue 4

July - August, 2004

## The Hickok 6000, How it works, How to Repair it and Maintain it

Part One - By Ed Brady, CRC Member

Recently, about two month ago to be exact, I picked up a Hickok Model 6000 tube tester at a radio club tailgate. Normally I would not have given it a second look since I already have a Hickok 752A. But given the price it was hard to pass by. I further rationalized my purchase by concluding one should always have a spare and that the compact size of the 6000 made it ideal for those quick tests I sometimes need to make on an over crowded bench.

Hickok introduced its 6000 in 1958 to keep pace with the skyrocketing demand for vacuum tubes brought about by the introduction of the television set. The 6000 series was unique in that it was a massive departure from the evolutionary approach Hickok used with all its previous tube tester introductions. The 6000 series is based on the 600 series tube tester but is more compact and some of the flexibility and sockets were removed. At this time semiconductor devices were still very expensive and used only in low power applications, but Hickok made sure this tester was ready to deal with this growing market segment by including the ability to test transistors and diodes. Another unique aspect of the 6000 series was its use of a removable tube socket adapter. This adapter gave Hickok a unique marketing edge over its competition. The 6000 would never become obsolete. With the use of the socket adapter, the 6000 could be upgraded to accommodate any new tube configuration. Through the use of this adapter,



the 6000 could be configured to test older pre-WWII tubes, foreign tubes, special purpose tubes and even the newer Nuvistor, Novar and Compactron tubes. An added bonus of the adapter was that it made replacing worn out sockets easier and less expensive.

The 6000 series was produced from 1958 to 1969 and came in four different versions, the 6000, 6000A, 6000B and 6005 with VOM. The most common of these appears to be the 6000 and 6000A. The 6000 has sockets for 4-pin up to 9-pin mini. The 6000A does not have 4,5,7 pin older sockets, but it does have the 9 and 12 pin sockets for testing Nuvistor, Novar and Compactron tubes. The 6000A replaced the 6000 around 1963 and I have to assume

this caused a few problems among buyers. Since the 6000A does not have sockets for 4, 5 and 7 pin sockets it cannot test older tubes. As a matter of fact it cannot even test its own tubes, the 83 or 5Y3. This was a big issue if you were trying to repair a pre 1950's radio. Hickok responded to this by offering the RSP-4 socket module, which allowed testing of the early tubes. Some of the information on the Hickok

6000 indicates that at some point after its introduction, Hickok revised its selling policy for the 6000A by giving the customer the option of purchasing the 6000A with its standard module or the RSP-4 module. I have not been able to verify if this is true or not.

If you are in the market for a Hickok 6000 series tube tester, it is important to keep these variations in mind because most of the models that show up for sale are the 6000A without the RSP-4 adapter. This tube tester will not test the tubes that most of us old radio collectors are interested in.

# COLORADO RADIO COLLECTORS ANTIQUE CLUB

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### **MESSAGE FROM THE PRESIDENT**

**Due to circumstances, there is no President's Message for this issue of the Flash.**

Plan to be at the next CRC club meeting on July 11<sup>th</sup>. If you haven't already paid your 2004-2005 membership dues, this would be a good time to get it done.

### CRC OFFICERS 2004-2005

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### CRC MEMBERSHIP

Annual membership in the CRC runs from **June to June**. Annual dues entitles members to a full year (6 issues) of the club publication "The Flash!". Membership provides participation in club events such as the annual April Show, mid-summer picnic, September auction as well as our semi-monthly meetings and swap meets. Dues also entitle you to club officer elections, excellent discount prices on current hobby publications and the Antique Radio Classifieds annual subscription raffle every May!

Current annual dues are \$12. New memberships will be prorated to renewal on the following June, i.e new members joining in May should submit \$12, in December \$5, etc.

### CRC MEETINGS

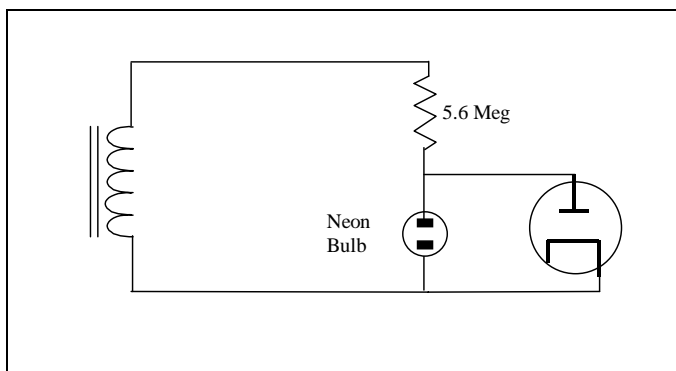
Meetings are held on the second Sunday of every other month starting in January (except 3rd Sunday of May) at 1:00pm at the Museum of the Americas Bldg., 2nd floor, 863 Santa Fe (between 8th & 9th Aves.). The

(Continued on Page 3)

### Basic Tests Offered by the Hickok 6000 Tester

Tube testers offer a combination of 5 basic tests to indicate the condition of the tubes it tests. These include, a “shorts” test, an emission test, a transconductance test, a gas test and a filament current test. The Hickok 6000 provides 3 of these functions: a “shorts” test, a transconductance test and a gas test. To deal with the rapidly growing semiconductor market, the 6000 line also provides a test mode for transistors, rectifiers and diodes.

The “shorts” test of a suspicious tube should always be performed prior to any other test. This will insure that an internal short will not cause irreparable harm to the tube tester. The majority of tube testers use one of two methods for finding internal tube shorts. The first method applies an AC voltage between each tube element and uses a neon lamp indicator circuit detects the short circuit current or leakage current between each set of elements. This is the least expensive method of detecting shorts and is the method employed in the



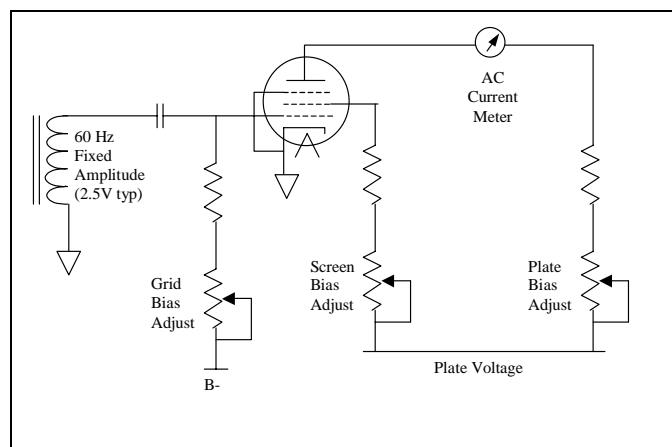
Hickok 6000.

Shorts Test Using Neon Bulb.

This method of testing for shorts has one significant deficiency in that it requires a series resistance to keep the neon lamp from burning out when no short exists between tube elements. This resistance imposes a limit on the maximum leakage resistance that can be detected. For the 6000 the limit is around 5 mega-ohms. In most circuit applications a 5 mega-ohm leakage path will not cause any problems. However a leakage resistance of this magnitude could cause problems in the radio AGC circuits. Since the Hickok 6000 uses this method, it is important to remember this limitation. More expensive tube testers replace the resistor and the neon bulb with a very sensitive ohmmeter. This ohmmeter can be constructed from an independent meter or be combined with the emission/transconductance indication meter. The

method used and its relevance to your particular needs or wants should be considered when making your own tube tester purchase.

The Hickok 6000 checks the tube quality using a transconductance test, abbreviated Gm. The test can be set up to provide a replace-good indication or provide the actual transconductance value in micromhos. Transconductance provides an indication on how well the tube functions as an amplifier and is determined by biasing the tube as per the manufacturer specifications and applying a small-signal control voltage to the grid. The resulting plate current is then measured via an AC meter. The ratio of the plate current to the grid voltage indicates the transconductance.



Simplified Transconductance Measurement Circuit.

Since this is a dynamic test it more accurately duplicates the operating conditions under which the tube functions and thus gives a better indication of the health of the tube than the alternative method: emission testing. However the transconductance test does have its limitations. Accurately measuring the transconductance requires a very small grid control voltage. As a result, it does not offer a good method of testing tubes where the normal input grid signal may be 10's to 100's of volts. Transconductance testers are also not well suited for testing output or power rectifier tubes. These tubes are designed to handle large plate currents, which a transconductance test cannot adequately verify. As a result the transconductance tester may indicate the tube is good when its electron emission is not sufficient to provide adequate current flow under normal operating conditions. These types of tubes are probably better tested with an emissions tester.

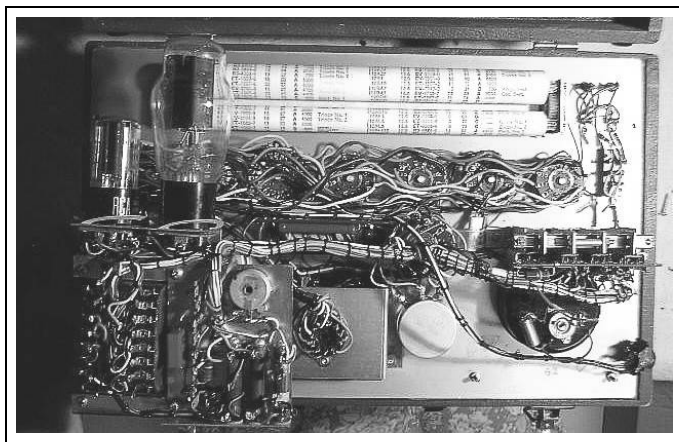
Finally the Hickok 6000 provides a gas test. This is a very important test, because circuit problems associated with gassy tubes are difficult if not impossible to isolate. The gas test is performed by

setting up the tester to perform a transconductance test while switching a high series resistance into the grid circuit. The presence of gas in the tube allows current to flow from the grid. This current results in a voltage drop across the grid series resistance, which the tester measures. The Hickok 6000 can measure grid current with a resolution of approximately 1.66 microramps. Tubes with gas emission of 3.33 microamps or more should be rejected according to the Hickok documentation. It should be noted that the flow of grid current can also be caused by a phenomena called grid emission. Grid emission occurs when the grid becomes contaminated with some of the cathode oxide material. This contamination causes electron emission from the grid wire once the tube heats up. The Hickok 6000 can detect the presence of either grid emission or gas although it cannot distinguish between the two.

### What to Do After You Bring It Home

Unless you are lucky enough to have purchased your new Hickok 6000 tester from a reputable Hickok restorer, the odds are your new tester is going to need some general maintenance and possibly calibration to get it operational. Luckily Hickok tube testers were well designed and it is rare for them to develop problems. Most servicing of Hickok tube testers requires little beyond a few spare parts and a good DVM. But it does require some electrical knowledge along with good safety practices when working with line voltages.

Underside of the tube tester chassis



The first step should be to clean the tester up to remove all the accumulated dirt and grime. Depending on how well the tester has been cared for this could be a significant task. The outside of the case and the operating panel can be cleaned with water or glass cleaner. Neither should remove the

marking on the panel although it is a good idea to test a corner area before cleaning the entire face. The glass cleaner will do a better job of cleaning grease. For tough grease you might try some 409 cleaner. Again check a small area first to insure it does not lift the lettering. I used a little 409 to remove some tough grease buildup. It did a great job and as an added bonus, it removed the oxide buildup on the face which brought out the color. A recommendation I found on the internet suggested applying WD-40 to the operating panel after cleaning. It can be sprayed on but all excess should be wiped off. The application of WD-40 will displace any moisture left on the panel and will provide a protective coating for the metal surface.

Care should be taken when cleaning the plastic meter cover. These covers tend to build up static charge rather easily. Just dragging your finger across it can cause enough static build up to effect the meter operation: typically sticking or other strange behavior. I found this out first hand. Cleaning should be done with an antistatic cleaner. If you use another product the odds are you will generate a static charge on the cover. Luckily the charge will dissipate over time and these problems will go away. Also make sure the roll chart moves freely, if it doesn't fix it. Otherwise at some point in time you are going to tear it and it will be almost impossible to replace.

Next clean the case. A wet cloth should do a great job here. If the case has tape or sticker residue, use a little Goo-Gone to remove it. Once the case is cleaned, Pledge or a similar spray furniture polish should be applied to protect it. Pledge will restore the shine to the cloth covering without the oily feel. Armor All can also be used, but I do not like the oily sticky feeling it leaves behind.

Once the outside has been dealt with, its time to open the tube tester up and take a look inside. Begin by checking the tubes. It should contain an 83 and a 5Y3. The 83 is a mercury vapor rectifier tube and depending on its condition may look a little strange on the inside. If you have another tube tester it might be a good idea to pull these tubes and verify their operation.

The next step is to clean all the pots, switches and selectors. I recommend using a good non-conductive contact cleaner. **DO NOT use WD-40 or other conductive cleaner for this.**

**WD-40 is a conductive material and the phenolic wafers used to create the selector**

**switches will absorb it ultimately ruining the tester. Even if the tube tester continues to work, the WD-40 could leave the tester with a potential fire hazard; D-40 is flammable. I know of at least once case of a radio catching fire as a result of using WD-40 on a band selector switch.**

Spray the contact cleaner on all the switches and then rotate them to help knock off any build up. You can also use a cotton swab but make sure you remove any cotton fibers that might be left behind. The push-buttons contacts can be cleaned with a pipe cleaner if needed. In some cases a simple cleaning will not remove all the crud and oxidation that has built up on the contacts. This was the case with my new tube tester. To fully remove the oxidation, I had to resort to carefully scrapping off the remaining material. I used a small flat head screwdriver to clean the selector switch plates and a dental pick to clean under the contacts. If you decide to clean the contacts be very careful. You can easily bend them and they will no longer make proper contact with the conductive ring. I ended up disassembling the push button assembly to clean these contacts.

The reason for going through all this work is to minimize the resistance between these contacts. I found contact resistance as high as a few 1000 ohms in my tester. The tester will not work properly with these types of resistances. This is especially true for the filament selectors where as much as 1 amp may be flowing through the contacts. An extra ohm of resistance combined with this much current will drop the filament voltage at the tube by 1 volt. The tube will not check properly with 5V applied to the filament when 6.3V is required. In some cases cleaning will not take care of all the resistance issues. With my tube tester some of the problems were a result of poor contact between the selector ring and the contacts. I had to carefully bend the contacts to get a good connection between the two surfaces. Once all the switches are toughly cleaned, it is worth the time to check the resistance between the common and selector contacts. If any selection has more than an ohm of resistance more cleaning may be necessary. Before making these measurements, short the ohmmeter leads together to determine the meters resistance offset. If the meter has a zero ohm adjustment then use it to remove this offset. If the meter does not have a zero adjustment then record the offset value and subtract it from all readings to determine the actual resistance.

Also check the pots to insure that wiper makes good contact throughout its entire rotation. Over time the spring in the wiper can weaken preventing the wiper from making good contact with the resistive material in the pot. This problem manifests itself as resistance spikes at certain locations across the pot rotation. If a pot exhibits this problem, it will throw off the reading of the tube tester. Checking for this condition can be done by hooking an ohmmeter between the center terminal and one of the outer two terminals of the pot and rotating the pot shaft. While slowly rotating the pot shaft, use the meter to check for abnormally high resistance readings that do not follow the normal increase or decrease in resistance value. For example the meter reads 10,000 ohms at one location but to either side the resistance is 900 and 1000 ohms. This will indicate that the wiper is not making good contact with the resistive material. This can be fixed by carefully bending the wiper. Keep in mind that analog and digital meters have a limited transient response time so rotation of the pot shaft must be performed at a rate slower than the response time of the meter or you will not be able to see the resistance spikes.

Underside of the interchangeable tube socket assembly



Use contact cleaner to clean all the tube socket contacts including the connector connecting the tube adapter assembly to the tube tester chassis. After spraying the socket, insert and remove a tube to help with the cleaning action. If the pins are excessively loose, then socket replacement may be necessary.

It is also a good idea to check all the fixed resistors to insure that they are still in tolerance. All

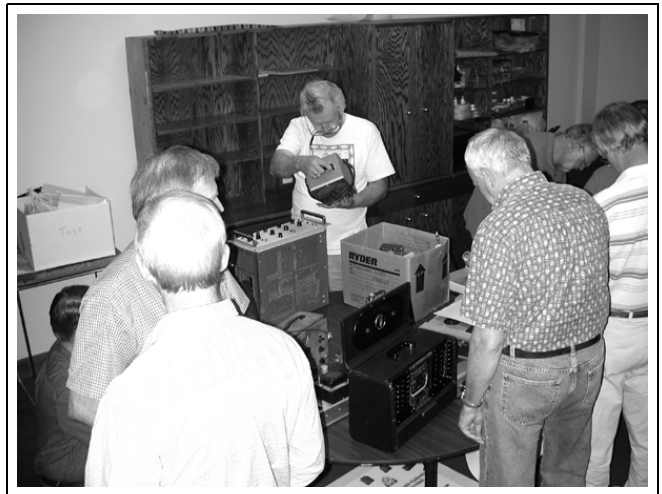


# May/04 CRC Meeting "Doings"



New CRC member Dan Becker displays a sales case for 1920's batteries.

CRC members inspect the unusually high quality raffle items.



CRC President Dennis Laurence conducts the meeting safely behind the raffle items.



Tom Puliot describes his eBay find of a 1917 IP-500 passive receiver.



# Collector Books for Sale

Special CRC prices. Order at club meetings. Mail order shipments: add \$2.00 postage for each book ordered. Info/order: Charles Brett, 5980 Old Ranch Road, Colorado Springs 80908, (719) 495-8660, [brett3729@aol.com](mailto:brett3729@aol.com). *void all other listings*

	Retail	Club
RADIOS, (GENUINE PLASTIC) OF THE MID CENTURY Jupp & Pina, hard bound, 219 pgs., 1998 PG., 450+ color pics	\$30.95	\$28.00
ANTIQUE RADIOS, COLLECTOR'S GUIDE - 4th EDITION Bums, 1997 values, revised & updated, new photos, 248 pgs	\$18.95	\$15.00
GUIDE TO OLD RADIOS, POINTERS... - 2nd EDITION Johnson, 277 pgs, 1995-96 prices	\$19.95	\$15.00
ANTIQUE RADIO RESTORATION GUIDE - 2nd EDITION Johnson, 144 pgs, repairing, refinishing, cleaning	\$14.95	\$12.00
RADIO, EVOLUTION OF THE - VOLUME ONE 227 pgs, 118 in color, More than 800 radios pictured, 1992	\$22.95	\$18.00
RADIO, EVOLUTION OF THE - VOLUME TWO 226 pgs, Radios of the 1920s to 1960s, with 93-94 values	\$24.95	\$19.00
TRANSISTOR RADIOS, COLLECTOR'S GUIDE VOL. II Bums, 1996 prices, Full Color	\$16.95	\$13.00
ZENITH TRANSISTOR RADIOS, 1955-1965 Smith, 1998 PG., 160 pgs, 226 color pics, info, deser.	\$20.95	\$22.00
THE ZENITH TRANS-OCEANIC (THE ROYALTY OF RADIOS) Bryant and Cones, 160 pgs, 1995	\$20.95	\$22.00
ZENITH RADIOS THE EARLY YEARS 1919-1936, Cones 1997-98 Price Guide, 223 pgs, 100's Photos, Desc., Hist.	\$20.95	\$22.00
RADIOS BY HALLCRAFTERS, revised 2nd edition Dachis, 1999 values, 220 pgs, 1000+ pics, id's, history	\$20.95	\$22.00
CLASSIC TV'S, PRE-WAR THRU 1950'S 86 pgs, color & b/w pics, descriptions, etc.	\$18.95	\$15.00
Machine Age to Jet Age, Radionama's Table Radio Guide - III, 33-'62 Stein, 256 pgs., 100's of b/w photos	\$29.95	\$24.50
TRANSISTOR RADIOS, 1954 TO 1969 Norman Smith, with prices, 160 pgs, 1000 photos, 1998	\$20.95	\$22.00
PHO CO RADIO: 1928 - 1942 Ramires & Prosser, 160 pgs, 828 pics & drawings, 1993	\$20.95	\$22.00
RADIO AND TV PREMIUMS Jim Harmon, 256 pgs, 200+ photos, 1997	\$24.95	\$19.00
RADIO MANUFACTURES OF THE 1930'S VOL. I Alan Douglas, 225 pgs, 1988	\$24.95	\$19.00
RADIO MANUFACTURES OF THE 1920'S VOL. II Alan Douglas, 266 pgs, 1989	\$20.95	\$22.00
RADIO MANUFACTURES OF THE 1920'S VOL. III Alan Douglas, 285 pgs, 1991	\$20.95	\$22.00
CRYSTAL CLEAR VOL. 1 Maurice Stevers, 282 Pgs., 1991	\$20.95	\$22.00
CRYSTAL CLEAR VOL. 2 Maurice Stevers, 252 Pgs., 1995	\$20.95	\$22.00

RADIO TUBES AND BOXES OF THE 1920'S George A Fehner, 112 Pgs, 1999	\$26.95	\$20.00
70 YEARS OF TUBES AND VALVES, 2ND EDITION John Stokes, 264 Pgs, 1997	\$29.95	\$22.00
RADIO DIAGRAM SOURCEBOOK Richard Gray, 264 Pgs, 1996	\$18.95	\$15.00
THE RADIO COLLECTOR'S DIRECTORY AND PRICE GUIDE, 2ND ED. Robert Ginder, 524 Pgs, 1995	\$26.95	\$21.00
COLLECTOR'S GUIDE TO VINTAGE TELEVISION Dudral & Glenn Bubenheimer, 200 Pgs, 1999	\$15.95	\$13.00
NOVELTY RADIOS, VOLUME 1 Mary Bums & Robert Breed, 223 Pgs, 1995	\$18.95	\$15.00
NOVELTY RADIOS, VOLUME 2 Mary Bums & Robert Breed, 199 Pgs, 1999	\$19.95	\$15.00
COMPLETE PRICE GUIDE TO ANTIQUE RADIOS: PRE-WAR CONSOLES Mark Stein, 235 pgs, 100's of b/w photos	\$26.95	\$22.00
TUBE TESTERS AND CLASSIC ELECTRONIC TEST GEAR Alan Douglas, 166 Pgs, 2000	\$25.95	\$19.50
COLLECTOR'S VACUUM TUBE HANDBOOK, VOLUME 1 Robert T. Millard, 196 Pgs, 2001	\$25.95	\$19.50
SIX VERTONE ANTIQUE RADIOS 1930 - 1942 Stein, 239 pgs., 2001	\$34.95	\$25.50
ANTIQUE RADIOS COLLECTOR'S GUIDE 5th EDITION John Shusser, 264 Pgs., 2001	\$19.95	\$15.00
RADIOCRAFT JUBILEE - REPRINT OF 1938 EDITION Hugo Gernsback, Vestal Press	-----	\$12.00
CLASSIC CONE SPEAKERS Batford & Jane Chidester, 122 Pgs, 2001	\$25.95	\$19.50
TUBE LORE Ludwiel Sibey, 186P ggs, 1996	\$29.00	\$15.00
ARTHUR COLLINS RRADIO WIZARD Ben Sterns, 394 Pgs, 2002	\$18.95	\$14.00
MACHINE AGE TO JET AGE - VOL. I Mark V. Stein, 256 Pgs, 1998	\$24.95	\$21.00
MACHINE AGE TO JET AGE - VOL. II Mark V. Stein, 358 Pgs, 1997	\$28.95	\$23.00
TABLETOP RADIOS - Vol 1 Mark V. Stein, 240 Pgs, 2002	\$29.95	\$22.00
A. ATWATER KENT Williams & Volkowicz, 108 Pgs, 2003	\$25.95	\$19.50
THE WOOD FINISHER Bruce Johnson, 341 Pgs., 1993	\$12.00	\$10.00
THE WEEKEND REFINISHER Bruce Johnson, 296 Pgs., 1989	\$12.00	\$10.00
THE PLAYING MAN'S MANUAL Johnson	----	\$10.00
THE FABULOUS VICTROLA "45"		

Phil Vourstis, 176 Pgs, 2002	\$29.95	\$22.00
ZENITH RADIOS THE GLORY YEARS 1936 - 1945 Cones, Bryant & Blankship, 256 Pgs, 2003	\$34.95	\$25.50
ZENITH ILLUSTRATED CATALOG AND DATABASE 1936 - 1945 Cones, Bryant & Blankship, 182 Pgs, 2003	\$29.95	\$22.00
THE ALL AMERICAN FIVE RADIO Richard McWhorter, 92 Pgs, 2003	\$19.50	\$15.00
E.H. SCOTT...THE DEAN OF DX, 2ND EDITION Marvin Hobbs, 240 Pgs, 2003	\$29.95	\$27.50



# The Open Trunk

Member submitted advertisements



Submission of Sell/Want ads are always free to CRC members. Non-members may advertise in the Flash for \$0.20 a word. Display advertising is available by contacting the CRC publisher for info and rates.

## WANTED:

- Philco model 70. Need speaker, tube shield, front grille panel, rear cabinet arch support, knobs.
- Mirrored dial and knobs for sparton 1568. Would take same from 1068 or 1268. Would buy whole chassis or parts radio.
- Center bakelite section for Emerson 149. Will buy whole radio.
- Good cabinet for Airline "little miracle"
- One knob for a Grunow radio. Measures 1-1/16" x 5/8" deep.



**Bob Cofer**, (303) 257-9598  
radiocowboy62@hotmail.com

05/04

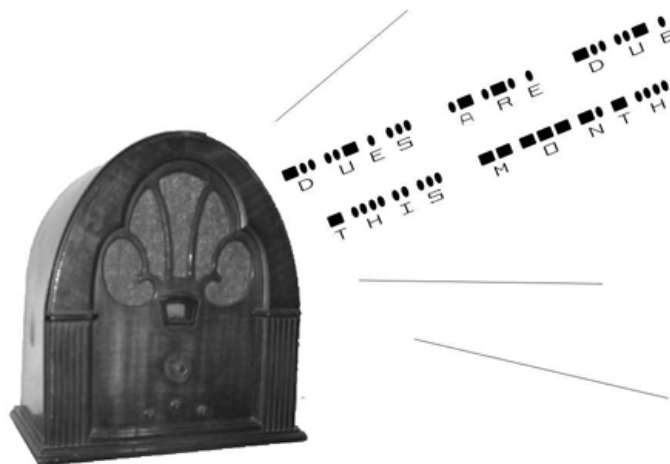
**WANTED:** Morse keys/bugs/paddles, Allied Radio/Knight Kits, "heavy metal" communications gear (Hallicrafters, Hammerlund, etc.).

**Robert Baumann**,  
303-988-2089, rgbdenver@att.net

07/04

**FOR SALE:** A/K model L chassis with speaker, Airline Cathedral, Various Bakelite & Plastic radios, Various Transistor radios, Fluke 12 multimeter, Numerous 1940s radio magazines, Spool of old style coil wire, and "1926-38 Radio Diagrams" by Beitman. Photos available online. **Wayne Gilbert**  
303-431-6774 wagil@aol.com

07/04



**Next CRC Meeting - July 11th - Museum of the Americas**  
**863 Santa Fe - 1:00pm**  
**Tailgate Sale After the Meeting in the Museum Courtyard**

**Due you remember that CRC dues are due!?**



**Colorado Radio Collectors**

**Antique Radio Club**

**417 S. Queen Cir.**

**Lakewood CO 80226**

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