HOLLOW STATE NEWSLETTER

"For lovers of vacuum tube radios"

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HSN is produced and published by and for the community of those who appreciate the fine accomplishments of the manufacturers of 'top of the line' vacuum tube communication radios and auxiliary equipment. Originally created by a group of R-390 users, **HSN** has expanded to include industrial, military, and consumer grade receivers by Collins, Hammarlund, National, Hallicrafters and others. **HSN** includes tips, modifications, alignment and restoration advice, product reviews, parts, tubes and service sources, and subscriber buy/sell information - all provided by subscribers and friends of **HSN**. See page 8 for submissions, disclaimers, reprinting, copyrights, subscriptions, reprints, and the Editor's and Publisher's Corner.

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"SELECTED REPRINTS" NOW AVAILABLE

Reid Wheeler, Editor

Since assuming the editorship of the Hollow State Newsletter in 1993, a major project has been to sort through the early issues and extract the items of lasting value and interest contained therein into a series of condensed publications. This sort of effort was last done in 1986 by then-editor Dallas Lankford who assembled the "Selected Reprints from Numbers 1 – 4".

We have now completed and are making available a collection of selected reprints from the earliest issues of HSN. The four-part collection includes:

- **R390 and R390A Receivers** (45 pages + index);
- **Collins 51J's, Hammarlund & Other Receivers** (39 pages + index.)
- **Test Equipment, Tubes, Servicing, Catalogs and Publications** (17 pages + index.)
- **Accessories & Miscellaneous** (7 pages + index.)

Order all four for $15. All prices include postage. Single back issues from #1 through #30 are no longer available.

These selected reprints cover items from Issue #1 (Spring 1983, Edited and Published by T.J. "Skip" Arey WB2GHA) through Issue #30 (Fall 1993, Edited by Dallas Lankford, Published by Ralph Sanserino). Perhaps someday in the future issues beyond #30 will also be included.

At various points I have added some editorial comments as to the current thinking on the various topics. I have also attempted to make notations where information contained in later issues may be in conflict with

the earlier issues as reprinted here, but the serious user of HSN information should review relevant information in all issues. Our standard disclaimer still applies:

> **"The Editor and Publisher assume no responsibility for the accuracy or safety of untested modifications or the reliability of suppliers of services, parts, or equipment mentioned in HSN. Opinions expressed in HSN belong to the individual contributors and do not necessarily reflect those of the Editor or Publisher."**

And also don't forget

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All orders for the "Selected Reprints" are to be directed to the Publisher, Ralph Sanserino. **Send check or money order payable to the publisher, Ralph Sanserino**. Prices apply to the USA, Canada, and Mexico. Double quoted prices to other areas. Checks and money orders must be in USA funds payable in USA clearinghouse format.

RE-CAPPING ELECTRONIC GEAR

Roberta J. (Bobbi) Barmore
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Capacitors (or condensers, depending upon your preference) are marvelous devices, and are one of the oldest passive components in the art.

However, taken as a group they are one of the *most* non-ideal components there is! That's as in "Platonic ideal," for the philosophy majors, and what it means is, real capacitors in the real world do not behave in the precise manner of their mathematical and/or hand-waving analysis models.

Therefore when you or I go to replace old types with nifty-keen brand-new ones, we are likely to find ourselves encountering unexpected results. Here's a little peek into the World of Capacitors:

Tip One: Old waxed paper and foil capacitors are usually marked to indicate the outside foil, which should be connected to the earthiest point. These critters can exhibit significant inductance (depending on internal construction, especially the method of attaching leads) as they are, viewed end-on, a big old spiral of conductors; the dielectric losses can be on the high side *and variable* thanks to the waxed paper and its hygroscopic and "hook" effects, and this can have the effect of introducing significant and possibly non-linear series resistance. Sometimes that's okay; more often, it'll bite you when you are not looking. They are known to have a limited useful life.

Tip Two: Electrolytic capacitors can also exhibit significant inductance (see above), high-ish equivalent series resistance (gets too high, they're goners), and, due to the nature of the film and its forming action, will always show some parallel or "leakage" resistance. Very handy if you need a lot of C in small space *and* you are not so much bothered by poor performance at higher frequencies. Excellent in power supplies, a bit iffy with audio; study your application carefully with an eye to the known flaws.

Tip Three: Tantalum capacitors are physically smaller than electrolytics for a given electrical size (but

likewise polarized) and will therefore be less inductive, have lower leakage, etc. Not bad for audio. Early tantalums were failure-prone; when you stuff lots of C into a small space you pay a price, in cash and in figuring out the how of it. Modern ones are pretty good; for audio applications needing high capacity and in which there'll be some DC to keep the electrochemical activity happy, they are a good choice. I'm told that recent construction styles are not inherently inductive.

Tip Four: Ceramic-disc and ceramic-film/monolithic capacitors come in many flavors. Some are tastier than others! The smallest, cheapest types use tricky ferroelectric ceramic formulations in a deliberate price/performance/size trade-off; X7R, Y5V, Z5U are typical examples, all of slightly differing characteristics. In general, these low-end versions will show variation in dielectric constant with temperature, applied AC and DC voltages and AC current, and possibly phase of the moon. At audio, they will introduce *measurable* amounts of distortion. They're handy for many bypassing applications. NP0 ceramics are another story. Usually larger and more expensive than their cousins, they've got plain old, just-lays-there-and-insulates ceramic dielectric, not unlike your Wedgewood Steatite dinner service for seven, and are useful just about anywhere. You'll pay more for them. My own preference is for monolithic packages over the disc type--the monos are a little more rugged physically. Axial-lead, glass-encapsulated monos are among the best, but hard to find; "dipped" radial-lead monos are common.

Tip Five: Polystyrene-film capacitors are nice, stable little jobs made out of what looks like Saran-wrap and tinfoil. Performance is at least as good as NP0s and the better micas, though a tiny gotcha lurks in the rolled construction, which, depending on internal connection methodology, can introduce some inductance. (More on that in Tip Eight, below) But it is much less than in wax capacitors thanks to the higher dielectric constant of the plastic. Drawbacks, you can melt 'em with speed and ease when soldering in, and the plastic does not tolerate most flux-removers well. Larger values (1000pF and up) are costly, and should be reserved for critical applications.

Tip Six: Mica capacitors are an old standby. Usually of "stacked" construction, they have good performance at RF though they can be cooked by excessive AC current (and will act very funky long before the smoke comes out). Long-term, they can suffer interesting failure modes, most typically the growth of metal-crystal "whiskers" into the mica, and this can cause breakdown. Well-sealed micas are fairly immune to this, but it's something to watch out for.

Tip Seven: Modern polypropylene and polyethylene (i.e., poly) capacitors are a good replacement for the old wax one. Generally well behaved through Medium Frequencies at least and may be available in both stacked and rolled versions.

Tip Eight: Mylar capacitors are also good replacements for old wax. Rolled mylar-film capacitors even *look* about the same (and will generally be marked to indicate the outside foil, etc.) Electrical properties similar to the poly caps in tip six. Usual rolled-construction caveats apply, although the free-bonus L will be lower than a wax capacitor of the same electrical size, mylar having a better dielectric constant than old candles and less surface area for the plates being thereby required. Internal lead connection methods commonly include shorting together the spiral-wound plate ends, which also serves to lower inductance.

Tip Nine: Alas, the wonderful air-dielectric variable capacitor can have problems, too. Known nasties, in no particular order, are excessively resistive shafts and wipers; frames that constitute a partial-turn inductor; lousy dielectric material, and too much dielectric other than air in the electrical field. Look for

good, solidly built capacitors with isolantite/ceramic insulation (made by Hammarlund, Johnson, Polar, Jackson, National, et al), and for really critical uses, keep an eye out for the old Nationals with insulated bearings.

Tip Ten: Solid-dielectric variable capacitors are simply not that good. Too many compromises. Wonderful things in a pocket Medium Wave receiver, otherwise "yeech". This does *not* include the good little mica trimmers, which are pretty handy and excellent in set-and-forget applications. Glass and PTFE "piston" style trimmers are another general exception that offers excellent performance in suitable applications.

Tip Eleven: Vacuum capacitors are about as close to the textbook ideal model as can be had. They cost like it, too. But when you need a really high voltage rating, good RF-current rating, and high stability, they're the only choice. Variable vacuum capacitors have a little bellows structure that allows the piston to move without breaching the seal, which will eventually fail and can be broken by excessive motion. (Most types incorporate a screw-on shaft that unscrews *before* you've overflexed the bellows). You *can* cook them with excessive RF current; I have a fine collection of 15pf "dead soldiers" from the output network of an RCA TV transmitter as evidence.

Last thought: with ***any*** capacitor, you can make up a fine little VHF/UHF resonant circuit with excess lead length. As a general rule, the shorter the better!

And there's just almost everything I know about capacitors, off the top of my head. 73, Bobbi

REPAIRING RACAL RA17 RECEIVERS

(with comments on Racal accessories and adapters)

By Rob Filby G0HJR

After servicing my last Racal RA17, I thought I would share my experiences with your readers. I have been involved with Racal equipment in an amateur and professional capacity for the last 16 years and in the last 4 years have repaired and serviced quite a lot or RA17/117 receivers and associated adapters including Transmitters, SSB units, LF units and panadaptors etc. So when a friend at Racal mentioned that he had an RA17 which needed "looking at", I offered my services. After finally picking up the kit it turned out to be a MK1, manufactured in 1957 and last refurbished in 1977.

On taking the covers off the units a lot of caps had begun to leak and resistors looked burnt and brittle. At this stage I took off all 3 major modules and worked on them separately. On the IF strip I replaced all the paper caps, anode, screen and HT dropping resistors. Then I dismantled the LC and Xtal filters, cleaned up the wafer switches and resoldered the connections. The BFO was dismantled and I replaced the anode and screen resistors and checked the paper caps. They seemed quite modern, so I left them in place. But as it turned out later on, that was a mistake.

I have a set of factory Test Jigs so I can test the modules outside of the set and this is what I did to test they were up to spec. The IF strip seemed to work intermittently, but then died. Eventually I traced the fault to a bad earth connection in the LC filter. Next came the first VFO that was totally dead, as one of the vanes

of the variable capacitor had been broken. It was easier to replace the whole unit with a known working one.

The last module was the second VFO and that turned out to be a later version one, not the original Mark 1. Once again I replaced all the screen, anode and HT dropper resistors and paper caps, put it in to the test jig and it seemed to work up to 550Kc/s on the film scale, but above that it died. After some head scratching I remembered something an RAF technician had told me. I checked the earthing clip on the oscillator section of the variable capacitor and found that when the VFO was tried above 550 Kc/s there was a bad connection. I cleaned that up and it seemed to work for a while. It was turned off and then on again and this time the VFO only worked up to 400 Kc/s!. The fault this time was an O/C choke in the anode feed of one of the valves, this was replaced and the VFO was okay. I then retracked it and knifed the capacitor vanes for equal calibration pips every 100 Kc/s.

After completing all 3 modules, I turned my attention to the main chassis. I replaced all the electrolytics in the power supply stage and changed the wire wound resistors to metal clad ones. Most of the HT dropper, screen and anode resistors were replaced, in fact two of the resistors fell to bits when they were unsoldered. I replaced brittle wire, i.e., no insulation was left on it due to the heat generated from nearby components. Then I generally resoldered dry joints as there were quite a few. Finally I got to the stage where I could re-assemble all the modules together. After connecting them together and powering up there was a smell of a burning resistor from the 2nd mixer compartment, i.e. V9 and V10. On closer examination it was discovered that the main HT dropper had burnt out. I know this happens when the vanes of C108 are shorted out, i.e., touching. On closer examination, the vanes were touching, so I carefully knifed them apart. This usually happens when people try to adjust C108 with the cover on and miss the slot on top of the cap and hit the vanes instead, with the result the vanes are shorted out. So I replaced the resistor and opened up the vanes of the cap. Switched on again and the same thing happened, i.e., R66 burnt out. Lovely, one of those faults!

So out came the board and I replaced it with another one. Yes, the same thing happened again. After a mug of tea and some head scratching I changed the last section of the 40Mc/s BPF as that looked a bit burnt and only connected one of the wires back up to it. This time the resistor survived, so I connected up the other wire and straight away there was the sound of frying bacon! I switched off and looked at the valves, as that was the only thing I had not checked. V9 was okay, but V10 had a horrible burn mark between pin 7 and earth, i.e., screen and earth. On checking the valve base of V10 sure enough the insulation had broken down between pin 7 and earth resulting in a hair line fracture.

So this was the elusive HT fault, you can gather the rest. I changed the valve base and the valve; this time the resistor survived. But according to Murphy's law as soon as one fault is fixed another one shows its head. This time there was no gain on the 37.5Mc/s BPF according to the wobbulator. This fault was due to a duff silver mica capacitor in L28. So I then also decided to check out the 40Mc/s BPF and found that one of the coils was not soldered! I switched the set on for an hour, switched it off and then switched it back on an hour later and once again the set failed. After 20 minutes of signal injection and tracing, I arrived at V9. I measured the screen and anode voltages and found they were about 70v too high; also there was no cathode voltage. After V9 was swapped the set appeared to work.

I still had a bit of fine tuning to do, so I decided to leave the set on soak test for a while to see if any other faults occurred. After 3 days the HT fuse blew. I went to investigate and was greeted by the smell of a

burning resistor. Yet another valve had developed an internal short and as a result the resistor burnt up. I replaced the valve and fuse and switched on and was greeted by silence!. This time the LT side had developed an O/C, i.e., a dry joint, so as a result only half the set's valves were glowing. I resoldered it and got some noise out, but no signals. So it was finally tracked down to the diode detector valve, which apparently was not working, replaced it and the set sprung into life. The set lasted for a couple more days until the sensitivity died. It turned out that 3 of the 33pf silver micas in the 37.5Mc/s BPF had gone bad, so I changed them and peaked up the filter on the wobbulator. After several hours the amplitude had remained constant as displayed on the CRT.

After all these faults I didn't think anything else could go wrong, but I was to be proved wrong. After listening to 20m USB one night, I decided to have a listen on 40m LSB, but I was unable to resolve any LSB. Yet on 20m I could resolve USB on +/- 1.5Kc/s on the BFO. So I took the unit out of the receiver and changed the two .05uf caps which I had originally left in place. Afterwards I was able to resolve both USB and LSB. One other fault occurred after the set was moved from its rack to a bench. This fault was caused by a dodgy pin connection on valve base one. I took the offending pin out of the valve base and cleaned it up. After resoldering all the other connections the set was okay. After a bit of fine tuning the sets sensitivity was measured as 1uV for 100ua meter movement, which is not bad for a set that's 42yrs old.

Besides coming across the common receivers, one also finds numerous adapters.

There are 3 types of LF adapters, these all cover 10 – 980 Kc/s. The RA37 was the first one, then was superseded by RA137. This was similar to the 37, but it had a tuning scale included on it. Finally there was the RA237 which was designed for the RA117 RX. These adapters all took their HT from the associated receiver. The 37 and 137 had the same style plugs as used on the 17, whereas the 237 had BNCs.

Then there are 4 types of SSB units, RA63,98, 121 and 218. The two most useful units are the 63 and 218,these were used for SSB whilst the 98 and 121 were designed for ISB use. The 63 can be used with either the 17 or 117 receivers. The 218 was designed to be used with 117 receiver, and it had a fine tuning unit which varied the 1.7Mc/s o/p. The 1.7Mc/s was one of the IFs used on the 117 receiver. The 218 can be used with the 17, but the fine tune unit is inoperative as the 17 does not use 1.7Mc/s as one of its IFs. The 121 had a CRT and the 98 had a motor driven AFC. All these units operated from the 100Kc/s IF o/p of the associated RX.

Another useful unit is the MA197 pre-selector unit. This covers the frequency range of 1 – 30 Mc/s and was used when the RX was operated at the same site as the TX; the unit prevented overloading of the receiver's front end. Although overloading of the front end is unlikely in the average Ham shack, this unit still finds its place, particularly when used on 40M at night time as it cleans up the signal due to the close proximity of powerful BCST stations.

The RA66 is the panoramic adapter and was used to display a 1Mc/s spectrum on a built in CRT. When used with the RA17, a buffer amp stage MA251 was used. When used with the RA117, an MA282 buffer amp stage was used.

The MA79 is the universal driver unit. This covered the frequency range 1.5 – 30 Mc/s and had an o/p of 100MW. Its modes of operation were CW, DSB, SSB,FSK and ISB. There are two commonly available models, these are the 79G and 79H. The difference between these two models is that the H model can be

used with a synthesizer, although an MA284 needs to be plugged into the 1Mc/s octal base socket in the transmitter . The G version is basically the same except a 1Mc/s crystal is used in place of the MA284. There were various linear amps available for this kit, ranging in power o/p from 100w up to 10kw!

There are 4 types of synthesizer available, the MA150, MA250, MA350 and MA1350.

The MA150 has outputs of 1Mc/s and 3.6 – 4.6 Mc/s. This unit was used with the RA117 receiver and the MA79 transmitter . This unit was all valved and had a separate power supply and frequency standard unit.

The MA250, 350 and 1350 all have one thing in common and that is that they are all transistorized! The MA350 had outputs of 100Kc/s, 200Kc/s, 1, 1.7 and 3.6 – 4.6 Mc/s. This unit was used in conjunction with the RA117 receiver and the MA79 transmitter. For extra frequency stability the internal frequency standard could be isolated and an external high stability unit, such as the MA259 could be used instead.

The MA1350 has outputs of 100Kc/s, 1Mc/s, 118Kc/s and 2.1 – 3.1 Mc/s. This unit was used with the RA17 receiver and the RA98 SSB unit.

Finally the MA250 was designed for the Speedrace equipment, this was a remotely tuned receiver and transmitter terminals.

These three units are compact and quite difficult to repair as extender leads and boards are needed to extend the modules outside the set to repair them.

Finally, if any body need any advice or info on Racal gear, feel free to drop me a line, my address is as follows:

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SHORT SUBJECTS

None this issue

QUESTIONS AND ANSWERS FROM OUR READERS

This section will present questions from subscribers for which responses are solicited. If you can help in providing answers, suggestions or just plain good advice - please send them to the editor for inclusion in the next issue of HSN.

Nothing this issue

PUBLICATIONS OF INTEREST

Electric Radio – We have printed this before, but if you are serious about your hollow state equipment, you should consider subscribing to Electric Radio. This magazine is published monthly and contains numerous articles about your favorite hollow state gear as well as a good section of serious buy/sell ads. Annual subscription rates within the US are $28 2nd class, $38 1st class and $42 in an envelope. Canada (via airmail only) $42 US and other foreign countries (airmail only) is $54. Send your $$ to Electric Radio, 14642 Country Road G, Cortez CO 81321-9575. Phone/Fax (970) 564-9185. E-mail er@frontier.net. Back issues are also available – US orders are $34/year, $3.25 each or $265 for issues 1 through 120. Contact ER for foreign orders.

WANTED TO BUY / SELL / TRADE / WHATEVER

Nothing this issue

EDITOR'S AND PUBLISHER'S CORNER

This issue is my 18th since assuming the editorship of HSN from Dallas Lankford in 1993 . . . and Ralph Sanserino has been the faithful Publisher since 1991. We have seen, and managed our way through, the explosion of the internet, keeping HSN a viable publication. A major accomplishment was the completion of the summaries of the first 30 issue as described in the first article of this issue. As a constant reminder, we are running a little short on new and useful articles for publication. If you have an idea for an article but are not sure if it's appropriate or needed, please feel free to e-mail me, write, call, fax, etc. to talk about it. Your contributions are essential to the continuation of HSN!!

Reid Wheeler, Editor

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