THE HOLLOW STATE NEWSLETTER

SPRING 1986 No. 13

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EDITOR'S CORNER

Hello again from hollow state land! I am sorry for the slight delay in getting out issue #13, but as you can see, I have been very busy redesigning the newsletter and arranging to have it typeset. The system I am using is called TEX and was developed by Dr. Donald Knuth, a professor of computer science at Stanford University. The particular software I use, which runs on an IBM PC, was developed by a company in California called Personal TEX. And the laser printer which printed this issue is a Corona Data Systems (Cordata) LP–300. The amount of electronics which supported all of this is probably equivalent to a *large* building full of tube type equipment, so it is evident that solid state has definite advantages. On the other hand, I keep hearing gossip that none of the most recent and best solid state communications receivers is quite the equal of the best of our beloved hollow state gear. For example, Bill tells me that he picked up a Hammarlund HQ–150 a few years ago which he now uses mainly on the BCB, and he would not trade it for any new receiver. He says it runs rings around a Drake R–7 on the BCB. And Chris remarked recently to me that the Sony 2010 is a big disappointment on the BCB, with noticable overloading problems. I also recently picked up a DX–400 at a very good close-out price, and while it is useful for casual listening and for emergency use in the event of power failure, it just does not come close to my R–390A or HQ–180A for strong signal handling performance or for digging out the weak ones in the presence of background static or man-made noise. I often think that many of the younger DXers who have not been introduced to hollow state gear miss some DX because of the inferior performance of most solid state receivers.

Remember, this is your newsletter, and it exists only as long as you continue to supply us with material for publication. So please sit down and write us a card or letter with some information for the next issue.

SHORT CONTRIBUTIONS

AN/URM-25D: Fair Radio has a good supply of government reconditioned AN/URM-25D RF signal generators. I bought one which arrived in the original government cardboard packing container, with the unit and accessories in two seperate boxes inside the container. The unit was *very clean* with all new "weather stripping" insulation. The lid contained the accessories plus manual. The manual and all accessories were *brand new*, still in their original sealed packages. The only things missing were one spare 1 amp slow blow fuse, and two easy-to-find hex wrenches. It was listed in the Summer Supplement To Catalog WS-85, and was an excellent buy at $175 plus shipping. (Joe Bunyard)

ANTIQUE RADIO CLASSIFIED: This excellent monthly magazine will cease publication after the August 1986 issue unless 400–500 new subscribers are obtained by June 1, per an announcement in the March issue. The May issue stated that about half the needed new subscribers had been obtained. New subscriptions through August will be accepted on a pro-rated basis only at $1.25 per issue, e.g., June–August $3.75 (3 issues). If any HSN subscribers have an interest in older tube gear, mainly from the 1920's, '30's, and '40's, why not try a few issues? Send your check or money order to G. B. S. Enterprises, 9511 Sunrise Blvd., #J-23, Cleveland, Ohio 44133. You may not make the June 1 deadline unless Chris and I really hustle, but at worst you would receive the last three issues of a really fine publication. (Dallas Lankford)

GOSSIP: Much military electronics equipment is currently being bought up to fill orders going to small, third-world countries as reconditioned military supplies. Some large military surplus companies fill orders such as these regularly, doing much of the reconditioning themselves. Cabinets, for example, are a prime auxiliary item. An electronics surplus dealer in San Antonio regularly sends surplus scrap equipment to Japan by the container load. Individuals then come and take the equipment to their homes, remove every salvagable component from the equipment, return everything to the owner, and are paid for their labor. The dealer told me that he recently shipped an entire barn full of VTVM's, test equipment, cases, generators, etc., and is now filling it up again. (Joe Bunyard) [If you have been procrastinating about buying hollow state equipment or supplies, take heed. Ed.]

R-390A PARTS: R-390A less meters, 3TF7, and dust covers, visually inspected for completeness, $145, from Fair Radio, per FW 1985 Catalog Supplement. (Dallas Lankford)

R-390A MOD?: The November 1985 issue of *Ham Radio* contains an article "External product detector improves receiver performance," by A. Nusbaum, W6GB, which includes an R-390A mod claimed to improve sensitivity and noise figure. Part of this mod includes removing the IF transformer shields, clipping the Q-reducing resistors which are in parallel with the tuned circuits, and peaking all IF transformers on 455 khz. This does not seem desirable for several reasons. One purpose of the Q-reducing resistors and stagger-tuned IF transformers is to provide a flat IF response, especially in the 8 and 16 khz band widths. Tampering with the original design may degrade flatness and increase signal levels at the detector (which in turn may degrade strong signal handling performance). I suggest that this mod *not* be done for those reasons alone. Also, clipping the IF transformer resistors can bend the internal IF transformer wires so much that they touch the shield, causing reduction or loss of gain. I encountered just such a problem recently. For about a year I had been trying to find a problem in a spare IF subchassis which manifested itself as an intermittent decrease in AGC voltage, and decrease in sensitivity. But all tube voltages and resistances measured normal (as compared to a known good IF subchassis). The intermittent nature of the problem made it extremely difficult and time consuming to

trouble shoot, so I had slowly begun to replace every capacitor on the IF subchassis under the assumption that the problem was caused by an intermittently bad capacitor. A few weeks ago I had removed the IF transformer shields to make a record of the values of the Q-spoiling resistors, and on *close* examination I discovered to my amazement that some of the resistors had been clipped on one side, and that the internal wiring had been bent slightly outward. After repairing the damage, no further problems have been experienced. Enough said? Just for the record, older IF transformers usually have 47K ohm resistors for R511, R512, R553, and R554, and 82K ohms for R522, while newer units have 39K ohms and 68K ohms respectively. Incidentally, do not change the resistors in your IF subchassis. Apparently there are at least two different IF transformer coil windings, "old" and "new," and the resistor values are different by design. The intermittent gain reduction problem may also occur with "mint" IF subchassis. If someone has carelessly handled an IF subchassis, the IF transformer shield may have been bent slightly inward so that the internal wires touch the shield. An easy cure is to wrap a turn or two of insulating tape around the internal structures (in particular where the solder joints protrude) which might touch the shield. El cheapo black vinyl electricians tape will work, but I prefer Scotch 27 glass cloth electrical tape. (Dallas Lankford)

DIGITAL DISPLAYS: Grand Systems, P. O. Box 2171, Blaine, WA 98230 makes what is undoubtedly the Cadillac of digital displays for the HQ–180 (and many other hollow state receivers). Unfortunately, it has a Cadillac price, $279 plus $5 UPS shipping. This is not your run-of-the-mill digital display. It counts every frequency in sight, i.e., the main tuning oscillator, the 2580 khz crystal oscillator which converts the 3035 khz IF to 455 khz, the 395 khz oscillator which converts the 455 khz IF to 60 khz, and the 60 khz BFO, and it adds and subtracts all frequencies as required to display the *exact* frequency (the display reads to 0.1 khz) to which your receiver is tuned, in all modes (AM, SSB, CW). In AM mode it is, of course, impossible to tune accurately to the carrier frequency. But if you zero beat an AM signal with your BFO on, then you know its carrier frequency to within 0.1 khz. (Al Merrill) The Torrestronics WTK–1 at $135 plus $7 UPS shipping, from Universal Shortwave Radio, 1280 Aida Drive, Reynoldsburg, Ohio 43068, is easier on the pocketbook. It works with many common receivers, such as the HQ–180, SP–600J, HRO–60, and R–4A/B/C, and Universal Shortwave Radio will send you a photo-copy of the connecting instructions for your receiver if you provide them with a SASE. (Dallas Lankford)

CATALOG: For anyone who likes to tinker, I highly recommend the Jensen Electronics Tool Catalog, free from Jensen Tools, Inc., 7815 S. 46th Street, Phoenix, AZ 85044. They have almost every imaginable tool, including multiple spline wrenches needed for working on R–390A's and other military surplus equipment, pinpoint oilers, miniature wrenches, hundreds of kinds of screwdrivers, diagonal cutters, etc. (Todd Roberts)

R–648/ARR–41: This is an interesting military surplus radio which is available from Fair Radio and other sources from time-to-time. The ARR–41 is a newer, updated replacement for the famous BC–348 aircraft receiver, with several refinements, including 190–550 khz plus 2–25 mhz tuning range, mechanical digital tuning similar to the R–390 series, Collins 1.4 and 6.0 khz mechanical filters, diode tuning BFO, Collins PTO, and slug-tuned RF and IF stages. It is a great little receiver, and does a nice job on SSB. The main disadvantage is that it requires a 24 volts at 2 amps for the tube filaments, plus 250 volts DC at 100 ma and 150 volts DC regulated for the PTO and BFO. An excellent power supply construction article is on page 96 of the November 1978 issue of *73 Magazine*. The service manual, NAVAIR 16-30ARR41-502, is highly recommended. (Todd Roberts)

COSMOS PTO: I am so elated to have discovered that the Cosmos Industries PTO (blue label) has an end point adjustment! [Me too!! Ed.] As I recall, after finding nothing to adjust under the "proper" (slotted hex bolt) cap screw, I previously neglected to look any further. [I made the same mistake, and compounded my mistake by publishing an article

which stated that the Cosmos PTO has no end point adjustment. Ed.] The Cosmos end point adjustment slug is *behind* the transformer, and under a cap screw which is smaller than a regular looking screw. This small cap screw has a rubber grommet seal akin to the usual seal on the slotted hex bolt. I needed a small jeweler's screwdriver to angle into the hole after that cap screw was removed. (Dick Truax) [Dick has made a wonderful discovery. Many of us had assumed the Cosmos PTO, a late model R-390A PTO, has no end point adjustment. It is merely hidden behind the Z702 transformer. When doing an end point adjustment on a Cosmos PTO, it might help to remove the Z702 shield. Ed.]

R-390A 200 KHZ CRYSTAL: If your 200 khz calibrator crystal goes bad, and you can not find one on the surplus market, try Sentry Manufacturing Company, Chickasha, OK 73018, phone (405) 224-6780. An acceptable type is SC-6 (0.002% commercial grade). (Dick Truax)

51H: I had an ad in HSN #11 wanting a 51H receiver. You added a [? Ed.]. I am wondering what the model number of the Collins receiver before the 51J series was? See the enclosed advertisement from Rockwell referring to the 51N. The other page I have enclosed is from a Collins 51S-1 and 651S-1 sales catalog, printed February 1976, where they refer to the 51H as their first general coverage receiver in 1946. I was told by a fellow who said he knew just about as much about Collins as Art Collins himself that Collins never made a general coverage receiver prior to the 51J series. I would appreciate anything you could share with me. (John White) [I wish I could help, John, but I am mystified. Maybe one of our subscribers knows something and will share his information. Ed.]

3TF7: New 3TF7's are $39 each from Unity Electronics, P. O. Box 213, 107 Trumbull Street, Elizabeth, NJ 07206. The also have a nice assortment of antique tubes, some mounted on polished transparent acrylic bases, and a few large, old transmitting tubes made into table lamps! The top-of-the-line lamp uses a #357A World War II era transmitting triode, total height 19 inches, for $79. It looks nice in their catalog. Has anyone actually seen one of these lamps? (Dallas Lankford)

A SURVEY OF HAMMARLUND RECEIVERS, Part 1

Dallas Lankford

This is a revision of an article which I published in *DX News* in 1979. When I returned to BCB DXing in 1976 after many years absence from the hobby one of my pressing needs was for a good receiver. I had kept my eye on receiver developments over the years, but none of the newer (unmodified) receivers seemed to have specifications, especially AM selectivity, indicative of outstanding BCB performance. Moreover, a glance at the IDXD column in *DX News* revealed that older tube-type receivers, mainly Collins and Hammarlunds, were still very popular among BCB DXers. Since that time I have used the HQ-180A, HQ-150, and HQ-100A and have been very pleased with the performance of each of these fine old receivers.

What makes Hammarlund receivers so popular in the BCB DXer community? The most important reason, I think, is that all of the Hammarlund receivers have adequate to excellent AM selectivity together with good dynamic range. Without both of these features, a receiver will not be a good performer on the BCB. Many newer receivers are deficient in one or both areas. Granted, one can modify some of the newer receivers by installing ceramic or mechanical filters, or by making SSB selectivity available for AM reception, but these modified receivers are no better than the top-of-the-line Hammarlund receivers with regard to AM selectivity and dynamic range.

Hammarlund receivers, like most tube radios (except the Collins 51J and R-390 series), do drift a bit on the higher SW frequencies, and frequency readout accuracy gets worse as frequency increases, but the drift is only a problem for CW and SSB, and if the receiver has a 100 khz calibrator, then the frequency readout is adequate for finding any AM

broadcaster. Simple solutions for these problems are to buy or build a crystal controlled converter for the high frequencies you desire and buy or build a digital display.

In the following table I have summarized the main features of interest to DXers for tube-type Hammarlund receivers of the past thirty years or so. These features include receiver model, approximate first year of production, bands (frequency range), primary selectivity, and additional remarks of interest. The following abbreviations are used in the table—BANDS (frequencies in mhz): A = 0.54–1.32, 1.32–3.2, 3.2–5.7, 5.7–10, 10–18, 18–30, B = 0.54–1.35, 1.35–3.45, 3.45–?, C = 0.54–1.6, 1.6–4, 4–10, 10–30, D = 0.54–1.05, 1.05–2.05, 2.05–4, 4–7.85, 7.85–15.35, 15.35–30, SELECTIVITY: X = crystal filter, Q = Q-multiplier, LC = IF transformers, REMARKS: 1 = bandspread inoperative on BCB, 2 = passive notch filter, 3 = active notch filter, 4 = product detector for CW/SSB, 5 = regulated B+, 6 = dual conversion on BCB, 7 = dual conversion on higher SW bands, 8 = triple conversion on higher SW bands.

RECEIVER	YEAR	BANDS	SELECTIVITY	REMARKS
HQ–129X	1946	A	X	1(?),5
SP–600JX	1950	B	X,LC (455 khz)	1(?),5,7
HQ–140X	1953	A	X	1(?),5
HQ–150	1956	A	X,Q	1,3,5
HQ–100	1956	C	Q	5
HQ–160	1958	A	Q	1,2,4,5,7
HQ–145	1959	C	X	2,5,7
HQ–180	1959	D	LC (60 khz)	1,2,4,5,6,8
HQ–100A	1961	C	Q	5
HQ–180A	1962	D	LC (60 khz)	1,2,4,5,6,8
HQ–200	1969	C	Q	4,5

The single conversion Hammarlund receivers all have 455 khz IF's and the multiple conversion receivers all have a 455 khz strip at some point in the IF's. In all Hammarlund receivers, primary selectivity is obtained in one (or two in the case of the HQ–150) of three ways—by a five (or four in the case of the SP–600JX) position 455 khz crystal filter, a 455 khz Q-multiplier, or multiple tuned circuits in a 60 khz IF strip. The crystal filter has 6/60 db band widths of about 4.4/11, 3.6/10.6, 2.8/10.2, 1.0/9.4, and 0.5/9.2 khz/khz, while the Q-multiplier is continuously variable from about 2.9/26 to 0.3/18 khz/khz. The 60 khz IF strip in the HQ–180(A) provides 6 db band widths of about 6, 4, 3, 2, 1, and 0.5 khz with a 60/6 db shape factor of about 2.5/1. The SP–600JX has 6 db band widths of about 13, 8, 3, 1.3, 0.5, and 0.2 khz.

Popular opinion has it that steeper skirted selectivity is superior to shallow skirted selectivity, and that must be true to some extent, otherwise there would be no need for highly selective IF's. Thus one would expect the crystal filter and 60 khz IF to be about equal in the selectivity department, and the Q-multiplier to be a distant third. However, my ears rate the Q-multiplier and crystal filter about equal, and the '180's 60 khz IF slightly better, though not enough to make much difference in hearing most DX. This contradicts popular opinion, but apparently the Hammarlund Co. thought highly enough of Q-multiplier selectivity to make it the primary source of selectivity for their 1958 delux model, the HQ–160. And several top veteran DXers have used the HQ–100(A) or HQ–200.

Several Hammarlund receivers come in newer "A" models, whose main difference from the older models is that B+ is rectified by silicon rectifiers rather than a tube rectifier.

And many had a clock option or the option of one or more fixed crystal tuned positions, i.e., so-called "C" and "X" models. This makes nomenclature rather complex, e.g., HQ-180(A,C,X,AC,AX). There are also other differences between older non-A and newer A models. For example, early HQ-180's did not have a vernier fine tuning control which varies the 395 khz conversion oscillator about 3 khz and improves SSB tuning.

The notch (slot) filter on some models is a very useful feature on some occasions. Adjacent channel splatter and TVI can sometimes be reduced significantly, and annoying hets (when listening in the wider selectivity positions) can be almost completely eliminated. The Q-multiplier notch filter on the HQ-150 does not seem to be quite as effective as the passive notch filter on the HQ-145(A), HQ-160, and HQ-180(A), but is still very useful.

The HQ-150, HQ-160, and HQ-180(A) all have a built-in 100 khz calibrator which is nice for locating SW stations or calibrating the bandspread tuning for the ham bands.

The HQ-180(A) has a product detector and audio-derived AGC with slow, medium, and fast release times, which makes it the only tube-type Hammarlund receiver specifically designed for CW/SSB. The other Hammarlund receivers tend to overload when tuning around with the BFO on unless the RF gain is frequently adjusted. Why this should be I don't know (even my old inexpensive Hallicrafters SX-110 did not have this problem), but the Hammarlund receiver manuals point this out (I suppose so that users will not mistakenly conclude their receiver is operating improperly).

To a first approximation, Hammarlund receivers can be placed in two categories, economy and delux. I would classify the HQ-100(A), HQ-145(A), and HQ-200 as economy models, and the others as delux to a lesser or greater extent. The distinction is not clear cut, as can be seen by comparing features, and which receiver may appeal to an individual DXer is often a matter of personal preference. In my opinion, the HQ-180A takes top honors, though some DXers rate the SP-600JX and HQ-150 as equal or better on the BCB.

PUBLISHER'S CORNER

Gee, my poor old IBM wide-carriage Executive is blushing -- thanks to Dallas for improving the already-good typeface of HSN.

Just a word on the Hammarlunds -- I have a HQ-150, modified by Bob Foxworth, which I run with his own home-brew frequency readout and a McKay Dymek DP-40 tuner. I swear by it (not at it, hi!). I retubed it recently for less than $50 (that includes spares), and I'd put it up against any HQ-180.

Speaking of retubing, the tube source list will be coming up in the Fall or Winter edition.

 Prices quoted below the masthead on the front page apply to U.S./Canada/Mexico. Double all quoted prices for other areas. Checks must be payable to Chris Hansen and must be in U.S. funds payable in U.S. clearing house format. Write for an information sheet; it's available for a SASE.

We're currently working on a BEST OF HSN ISSUES 1-4, to be available probably with the Fall issue. Those of you who have already ordered sold-out back issues will get one; those who were unable to get those back issues will be able to buy this digest for $2.75 -- we plan for 8 pages (rather than the usual 6). Foreign price will be $5.50. Watch for it!

THANK YOU FOR YOUR SUPPORT. We couldn't do this without you.

Chris Hansen for the staff of HSN.

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EDITOR'S CORNER

It seems that interest in the newsletter is declining, as only two letters have arrived since I received my printed copy of *HSN* **13**. If this situation continues, *HSN* will likely fold by the end of the year. Had Al Quaglieri not written a long letter about Hammarlund receivers and related topics, it would have been very difficult to scrape together enough material for this issue. Thanks Al!

By the time I finished editing Al's excellent article and added my "Part 2," it was obvious that this was developing into an "all Hammarlund" issue. Between Al and me, we covered most Hammarlund receivers produced since WWII, but our knowledge of WWII and pre-war Hammarlund receivers is rather limited, primarily only what we have read in *QST*. If any of our subscribers currently uses or has previously used some of the WWII or pre-war Hammarlund receivers, we would very much like to hear from you, even if you are familiar with only one receiver. Be sure to include such things as all tuning ranges, selectivity band widths, where you get tubes, and especially your personal experiences using the receiver. Similar surveys and discussions of Hallicrafters and National receivers would be very timely and appropriate for *HSN*.

This document was produced with an IBM PC AT and a Cordata LP–300 laser printer using software developed by Personal TEX, Inc.

SHORT CONTRIBUTIONS

RECTIFIER MODS: If you own a hollow state receiver whose rectifier tube has been replaced with a plug-in solid state rectifier, you may wish to examine the power supply closely. A previous owner of my SP–600 replaced the 5R4 with a solid state plug-in and a 20 ohm 25 watt surge resistor. I am the unlucky guy who was using the set when the modification failed, causing a melt-down of one of the massive filter chokes. I almost had to call the EPA to clean up the gooey PCB's that leaked out. Needless to say, the original 5R4 tube is back in the SP–600 power supply. Hollow state forever! (Al Quaglieri)

SPEAKERS: I have tried the large, "late model" Hammarlund matching speaker with the HQ–100A, HQ–150, and HQ–180A, and my experiences have been uniformly bad: audio quality is poor, and the speaker causes all sorts of feedback problems. The best speaker I have found for use with these receivers is a Radio Shack # 40-1227A Indoor/Outdoor Speaker (8 ohms, 10 watts). It is not especially pretty, but it has good audio quality, and almost no feedback problems. It is about six years old, so it may have been discontinued. However, I would expect that Radio Shack currently sells something similar. (Dallas Lankford)

HEADPHONES: In my opinion, headphones are essential for DX-ing. Unfortunately, most headphones nowadays are 8 ohms (or thereabouts), while most hollow state receivers headphone outputs are rated at 2000 ohms nominally. For example, the HQ–180(A) manual states that you can use 8 ohm phones, which is true. But what it does not say is that audio quality will be poor: there will be objectionable hum. The solution is to mount a small audio transformer in a small metal enclosure, attach the inputs and outputs to standard 0.25 inch headphone jacks, purchase an extension cable with standard male headphone plugs on both ends from Radio Shack, and you are in business. I use a Calectro 4 watt transformer, part # D1-740, and use the 8 ohm secondary and 1000 ohm primary. There is a slight impedance mismatch at the primary, but it does not effect performance. Different transformers may be used, provided their power rating is adequate. One watt or more should work, but I like to under-rate components. (Dallas Lankford)

180 MANUAL SUPPLEMENT: I have written a nine page HQ–180 Series Manual Supplement which I'll send you for $2 and a SASE. It is written for all HQ–180 series receivers, A and non-A models alike. My supplement provides a quick summary of some of the more useful manual information, and additional information not in any of the manuals. For example, the two short contributions immediately above are variants of two items in my supplement. (Dallas Lankford)

HAMMARLUND COMMENTS

Al Quaglieri

There seems to be a shroud of mystery surrounding SP–600's, which is odd considering their proliferation on the surplus market. Here is some information you may find helpful.

The first "Super Pro" I know of is the SP–400X, made in the late 1940's, but an ad for it says, "... covers a new and wider range of frequencies ..." so there may be an earlier version. The SP–400X tunes 0.54–30 mHz, and has continuously variable selectivity. The net price in 1947 was $342, with the speaker an additional $5.25.

There are several versions of the SP–600. The SP–600JL and SP–600JLX have six bands: 100–200 kHz, 200–400 kHz, 1.35–3.45 mHz, 3.45–7.4 mHz, 7.4–14.8 mHz, and 14.8–29.7 mHz. The JL does not have the frequency control unit (another name for a crystal tuned channel selector with six positions), while the JLX does. The SP–600J and SP–600JX are similar, but cover 0.54–54 mHz in six bands, with continuous bandspread tuning throughout: 0.54–1.35, 1.35–3.45, 3.45–7.4, 7.4–14.8, 14.8–29.7, and 29.7–54.0 mHz. It takes many turns of the bandspread dial to get from one end of a given tuning range to another, and all tuning is through a single big knob. The other big knob is BAND SELECT.

The general design of the SP–600 is similar to the SP–400, but with "modern" miniature tubes. Another difference is that instead of continuously variable selectivity, the SP–600 has six band widths: 13, 8, 3, 1.3, 0.5 and 0.2 kHz. The wider three band widths are LC derived; the narrower three use a crystal filter which has a front panel phasing control.

The SP–600 was still being advertised in *QST* as late as May 1969. Also shown in that ad is an SPC–10 SSB converter with a tunable 60 db notch filter, seven step selectivity, selectable AVC, and many other features. A friend of mine has one of these connected to his SP–600JX, and he praises it up and down. [The SPC–10 is very similar to the Hammarlund HC–10 converter, which is essentially the 455 and 60 kHz IF strip and audio circuitry of an HQ–180. The main differences between the two are that the SPC–10 has an S–meter and 600 ohm audio line output, while the HC–10 does not. I have an HC–10 which I can assure you works well with an R–390(A). See *HSN* **11** for a more detailed description and user comments about the HC–10. Ed.]

There is a designation on my SP–600 schematic for selecting between normal operation and diversity reception. So there is some method of connecting two SP–600's together for diversity reception, but I have no other information in that regard.

A few years ago I replaced all the electrolytics, and have just re-tubed and aligned my SP–600JX. It still blows away almost every other receiver I have tried on the BCB and tropical bands, and holds its own nicely up to about 16 meters. The 29.7–54 mHz band is pretty much a throw-away, although I can hear many business band mobiles and pagers via FM slope detection. There is little 6 meter activity here, so I can't tell you how it behaves at the top end. I use a crystal frequency standard which is adequate for finding frequencies, but I must admit that a digital readout would be nice.

There is an interesting and useful article "Souping up the Super Pro" by John R. Leary, W9HWN in the January 1979 issue of *CQ*. John offered additional modification information to anyone who sent him a SASE. Perhaps the offer is still valid. His address is 438 Hamilton, Fortville, IN 46040.

I knew a real whiz named Dave Schneider who owned five or six of these monsters, maybe more now. Dave was a satellite communications systems design engineer, and was working on some kind of phase-lock loop for the SP–600. I would like to get in touch with him again, but I have lost contact with Dave since he moved from Valencia, CA about four years ago.

Not mentioned in Dallas' Hammarlund survey are the HQ–145A general coverage receiver [Yep, I accidentally deleted the HQ–145A from my survey, although it was included in the original *DXN* article. The HQ–145A is a newer (1961) HQ–145, sans rectifier tube, with solid state silicon rectifiers. Ed.], the HQ–110 (ham-band-only) and HQ–110VHF (ham-band-only covering 160–2 meters). There was also a bizarre general coverage receiver with a built in CB transmitter. [Now that you mention it, I recall that strange receiver. What was its model number? Ed.] I am also interested in the mysterious HQ–215, even though it is solid state. [I also did not include the HQ–170 and HQ–170A or their VHF variants. The HQ–170 series is a ham-band-only version of the HQ–180(A) which covers 160–10 meters, and the VHF version includes an internal factory installed converter which extends coverage to 6 and 2 meters. I owned an HQ–170AC-VHF briefly, but it was no better than an HQ–180(A) on the HF ham bands, so I sold it to a local ham who was doing some VHF AM experiments. I have been told the HQ–215 was Hammarlund's unsuccessful attempt to develop a solid state version of the Collins 75S–3. A recent issue of Ham Trader Yellow Sheets had an HQ-215 offered for sale at $135. Ed.]

The Hammarlund Corp. still lives, sort of. Its remaining assets were bought by Pax Manufacturing Corp., 100 East Montauk Highway, Lindenhurst, NY 11757, phone (516) 957-7200. Send inquiries to Peter or David Kjeldsen for price quotes. The deal, according to Peter, is that he, David, and their brother Robert jointly own Cardwell Capacitors, and their two sisters own Pax Mfg. Corp. which is in a building next door to Cardwell.

Although the two companies are technically separate, the three brothers operate both businesses. In 1971 Cardwell purchased the variable capacitor division of Hammarlund from Electronics Assistance Corp., its parent company. About five years later, Pax purchased the remainder of Hammarlund's assets. Peter told me that Hammarlund was purchased mainly for its military spare parts inventory, but many parts are still available for the HQ and SP series. Although quite a few electrical components are no longer available, Pax does seem to be well stocked with mechanical and metal parts, such as cabinets and faceplates. Also available are six *unused* SP–600VLF units which represent the last remaining unsold receivers of the once mighty Hammarlund line. The Pax warehouse covers about 20,000 square feet of floor area. In addition to Hammarlund parts, the warehouse contains Gonset, Dumont and RadioMarine parts and manuals. Peter mentioned that he has the last HQ–215 off the production line sitting on his desk, and although it is an attractive receiver, it never worked properly. I asked him what he meant, and he said it was just a poor design.

If you have been looking for Hammarlund parts or manuals, Pax Mfg. Corp. may have them. But be prepared to pay premium prices. The parts prices I was quoted were on the inflated side. On the other hand, remember that Pax *normally* does business with the U. S. government, e.g., $10 for a capacitor is a bargain. I'd definitely query Steve Bohac, R. D. #4, Box 750-A, Branchville, NJ 07826, orA. Wayne Cordell [See my article below for his address. Ed.] first, and only contact Pax when all else fails.

A SURVEY OF HAMMARLUND RECEIVERS, Part 2

Dallas Lankford

One way to obtain a Hammarlund receiver is through the periodic Wanted/For Sale column which appears now and then in *DX News*. There are many BCB DX-ers who still use Hammarlund receivers regularly, and occasionally they "retire" from the hobby and sell some of their equipment in the process. *DX News* is published by the National Radio Club, and orders or inquiries should be sent to the Publications Center, P. O. Box 118, Poquonock, CT 06064. A subscription is $21 per year (30 issues) for new members. Another source for Hammarlund receivers is the Ham Trader Yellow Sheets, P. O. Box 2057, Glen Ellyn, IL 60138. A subscription is $10 per year (24 issues), or $2 for a potential subscriber mini-subscription (4 issues). The current ham magazines, such as *QST*, *CQ*, *73*, and *Ham Radio*, seldom have Hammarlund receivers in their for sale ads. Also, Al tells me that Fair Radio usually seems to have SP–600's in stock.

Prices are variable, depending upon the cosmetic appearance, electrical and mechanical condition of the receiver, and other factors. Nevertheless, here are some numbers based on my observations over the last five years or so — HQ–100(A): $100–125; HQ–145(A): $100–150; HQ-150: $100–175; HQ–160: $100–175; HQ–180: $100–225; HQ–180A: $135–300; HQ–200: $325; SP–600J(X): $150–250. The HQ–200 price I have quoted here is outrageously high, but it is typical because few HQ–200's were made, and it is considered a collector's item. In terms of what you get, it is hardly worth more than about $125–150. Older Hammarlund receivers, such as the HQ–120, HQ–129, and HQ–140 are still occasionally seen in the $50–150 range, but are becoming rare.

There are several ways to improve the less expensive models. Since all have a 455 kHz IF at some point, all can be fitted with a 455 kHz mechanical filter. Chuck Hutton (*DX News* IDXD Editor) has modified his HQ–129X with two Collins 2.1 kHz mechanical filters and reports that it outperforms his R–390A. Mechanical filters are not cheap ($25–150 or more), but installing one or two mechanical filters in most of the Hammarlund receivers is probably the easiest way to get a state of the art receiver for the BCB or tropical bands. The center frequency of Hammarlund crystal filters is generally not exactly 455 kHz, but typically 2 to 4 kHz lower. This means that if you add a mechanical filter to one of the Hammarlund receivers with a crystal filter, then the crystal filter may not be used unless you change the crystal. My article "180 + Collins F455FA40 mechanical filter = super

180" describes one method of adding a mechanical filter to the HQ–180(A). It should still be available from the National Radio Club through their reprints service, or I'll send you a copy for $1 plus a SASE. Another way to improve the performance of Hammarlund receivers, except the HQ–180(A), is to add a Hammarlund HC–10 converter. The HC–10 is the 455 and 60 kHz IF, detector, and audio of an HQ–180(A), and originally came with an adaptor which plugs into the last IF tube socket of any receiver with a 455–500 kHz IF (provided the last IF tube socket is a miniature type). If the adaptor method is not suitable, the HC–10 manual also describes how to connect it to any receiver with a 455–500 kHz IF.

How do Hammarlund receivers compare to other older tube type receivers? In my opinion, very well. The Hallicrafters SX–100 and updated SX–122A are close in performance to the HQ–180(A), but the less expensive Hallicrafters receivers do not have comparable selectivity to their Hammarlund counterparts. For example, the SX–110 and its older equivalent SX–99 have a two position crystal filter which is no match for the Hammarlund five position crystal filter. Also, the top of the line SX–100 and SX–122A do not have 455 kHz IF's, so adding mechanical filters or attaching an HC–10 to them is out of the question. National receivers are used so infrequently by BCB DX-ers and I know so little about them that I am not able to make any knowledgable comparisons with them. The only receivers that may significantly outperform the Hammarlunds are the Collins. The most frequently used Collins general coverage receivers are the R–388 and R–390A. Neither of them is significantly better than most Hammarlunds in the selectivity department. Their advantages are mainly better dynamic range, better shielding, and digital tuning. However, the Collins receivers are more difficult maintain to repair.

In a short survey article it is impossible to cover all aspects of Hammarlund receivers well. A good source of information about receivers is *The N. R. C. Receiver Reference Manual*, Volume II, which contains, among other things, reviews of the SPR–4, R–388, R–390A, SX–122A, a capsule review of Hammarlund receivers, and articles about modifying older tube type receivers, such as the HQ–150. The National Radio Club may also still sell reprints of my article, "HQ–180 series receivers," or you may order it directly from me for $1 plus a SASE. Beyond this, *CQ* and *QST* have reviewed most receivers at one time or another, and both frequently included advertisements which are good sources of information. The following is a list of references I have come across: "The Hammarlund HQ–129X," *QST*, June 1946, pp. 24–25 & 108; "The HQ–150 receiver," *QST*, Dec. 1956, pp. 26–27; "The HQ–100," *QST*, Jan. 1957, pp. 34–36, also *CQ*, Jan. 1958, pp. 46–47; "The Hammarlund HQ–160," *QST*, Oct. 1958, pp. 45–47, also *CQ*, Mar. 1959, pp. 52–53; "The Hammarlund HQ–145 receiver," *QST*, June 1959, pp. 44–46; "The Hammarlund HQ–180 receiver," *QST*, June 1960, pp. 42–43, also *CQ*, Apr. 1960, pp. 59; "Feedback: HQ–180 frequency-conversion system," *QST*, July 1960, pp. 45; "HQ–100A," *QST*, Dec. 1961, pp. 60; "HQ–145X," *QST*, Dec. 1961, pp. 60–61; "Hum reduction in the HQ–129X," *QST*, Nov. 1950, pp. 106; "HQ–129X receiver improvements," *QST*, May 1959, pp. 38–40; "HQ–120X," *QST*, Dec. 1941, pp. 65; "Full-range selectivity with 455-kc. quartz crystal filters," *QST*, Dec. 1938, pp. 33–36 & 56–62. This last article is by D. K. Oram, the Hammarlund engineer who probably designed the original Hammarlund crystal filter. Subsequent Hammarlund crystal filter designs are really not much different from the original. My notes indicate that older issues of *QST* contain a wealth of information about early Hammarlund receivers. For example, the 1938 June (pp. 68), July (pp. 78), and Oct. (pp. 119) issues of *QST* contain interesting information about the Hammarlund "Super Pro," the first of the famous SP series. And the Dec. 1941 issue contains ads for the SP–210X (15–560 meters tuning range) and SP–210SX (7.5–240 meters tuning range), which sold then for $279. I also like *A Flick Of The Switch*, 1930–1950, by Morgan E. McMahon, published by Vintage Radio, and still in print, for example, in paperback from Fair Radio for about $10. This book contains *many* pictures of old receivers, including the first Hammarlund receiver, the Comet Pro (1932, 8 tubes, 14–200 meters), two models

of the "Super Pro," and one model of the New Series 200 Super Pro. I would presume that these older Hammarlund receivers are rare indeed, but occasionally they are found for sale. For example, the June 1986 issue of *Antique Radio Classified* offered a Comet Pro, with 10 coils, 1932 model, for $100.

Many exact replacement parts for Hammarlund receivers are available from Hammarlund Mfg. Co., Division of Pax Mfg. Corp., see Al's article above for their address and more details. I generally agree with Al's comments that Pax's prices are high, in my experience as much as five times the price of equivalent quality components which you can find at any good electronics supply store. Also, the last time I checked, Pax did not have many crucial parts, such as power transformers, multi-section high voltage electrolytics, meters, 24 hour clock-timers, and some specialized coils and transformers. Another source of exact replacement parts for Hammarlund equipmant is Blue Ridge Communications and Electronics, 770 New Stock Road, Weaverville, NC 28787 (704) 645-7070. I cannot guarantee the correctness of the phone number which was accurate as of March 1985, but my efforts to get information by phone were unsuccessful anyway. According to my notes, Blue Ridge Communications is owned or operated by Wayne Cordell, and I still see his ads occasionally in *QST*. I wrote them in March 1985, including a SASE, and received a five page list of parts. Again, many crucial parts are not available from them. For example, only two parts were available from the list of eight parts I wanted. And prices were high: $15 each for a used 60 kHz BFO oscillator coil and a 60 kHz IF transformer. At those prices, you are better off buying a second Hammarlund receiver and using it for spare parts. Some items are reasonably priced, such as original Hammarlund factory manuals for $12.50 each, shipped prepaid in the U. S. A. — HQ–100, HQ–120, HQ–145A, HC–10, HK1–B, PRO–310, RDF–10, CB–6, HX–50, HX–500, HXL–1, and SP–400SX Super Pro manuals only, name plates and labels for $3 each shipped prepaid — HQ–100 stick-on, HQ–110 stick-on, VHF stick-on, MR–50X stick-on, MR–60X stick-on, HQ–145A, HQ–170, HQ–170A, HQ–180, HQ–180A, HX–50, HX–50A, HX–500, Hammarlund (small for CB–23), CB–23, Hammarlund (large for HQ–180 or HQ–180A), and several other name plates, and a small selection of literature and brochures, including a Hammarlund Facilities Booklet which includes photos and a description of the Mars Hill plant for $12.50 . Blue Ridge Communications also offers a receiver alignment service for selected models at $18.50 per hour — HQ–100A (3 hours), HQ–100A (3 hours), HQ–140 (4 hours), HQ–145A (3 hours), HQ–150 (4 hours), HQ–160 (4 hours), HQ–170(A) (4 hours), HQ–180(A) (4 hours), and SP–600 (6 hours). Another potential source of Hammarlund service and repair is C. Osteen, Box 152, Mars Hill, NC 28754 who has advertised in *QST* in the past, but I have no other information about him. [Al also suggests that if all else fails regarding power transformer replacement, try: Peter W. Dahl Co., 5869 Waycross, El Paso, TX 79924, or for custom wound coils, chokes, and transformers: Caddell Coil Co., Poultney, VT. Can anyone supply us with the complete address of the latter? Ed.]

PUBLISHER'S CORNER

Hi, folks. Look on page 1 – Dallas is serious. We need contributions from all you hollowstaters out there if we're to continue our high standards. We *could* publish garbage, but we won't. Please send us your tired, your poor, your contributions!! AND NOW THE USUAL. All articles and information shared through this newsletter may be reprinted only with permission of the author. The publishing committee assumes no responsibility for the accuracy or safety of untested modifications or the reliability of suppliers of services, parts, or equipment mentioned in *HSN*. Prices quoted below the masthead apply to U.S.A., Canada, and Mexico – double all quoted prices for other areas. Checks must be payable to Chris Hansen and must be in U.S. funds payable in U.S. clearing house format. Write for an information sheet – it's available for a SASE.

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THE HOLLOW STATE NEWSLETTER

FALL 1986 No. 15

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EDITOR'S CORNER

Because this is your newsletter, you might like a brief description of the current procedure by which an issue of *HSN* is created. I usually begin editing the next issue about 3 months in advance, so today, August 25, *HSN* **15** has started its journey towards camera-ready copy. It is apparent that you should submit potential contributions at least 3 months in advance to be guaranteed consideration for the next issue, and that an item may easily wait 6 months *or longer* before it appears in print. Submission of material is no guarantee that it will be published, but we do *try* to use almost everything eventually. Layout, editing, and typesetting considerations may also delay publication of individual submissions. After an issue is almost finished, it is mailed to Chris for proofreading, and he adds his Publisher's Corner at that time. Next it comes back to me for final revisions, and finally a camera-ready copy is mailed to Chris. I'll ask Chris to describe the publishing and mailing procedure in his column.

About a month ago I received an upgrade of my typesetting software which is greatly improved and permits me to do things which were previously impossible. Among the improvements is an enhanced version of a TEX extension called LATEX, developed by Leslie

This document was produced with an IBM PC AT and a Cordata LP–300 laser printer using software developed by Personal TEX, Inc.

Lamport. This extension includes a "picture environment" in which one can compose drawings formed from straight line segments and quarter circle arcs of five predetermined radii using two predetermined line and arc thicknesses. That may not sound like much, and it isn't, because it takes an incredible amount of time to compose even a simple picture. But TEX and LATEX provide powerful macro features which I used to develop a simple schematic typsetting program. This issue of *HSN* is, therefore, *the schematic issue* in which I will give my schematic macros a thorough testing. I hope you like the show. My schematic typesetting macros are still in the process of development, and there are currently some things I can't easily do. So I will devote this issue mainly to a continuation of my mechanical filter discussion. This will also provide some additional time for *all* of you to send me something to put in the spring and summer 1987 issues.

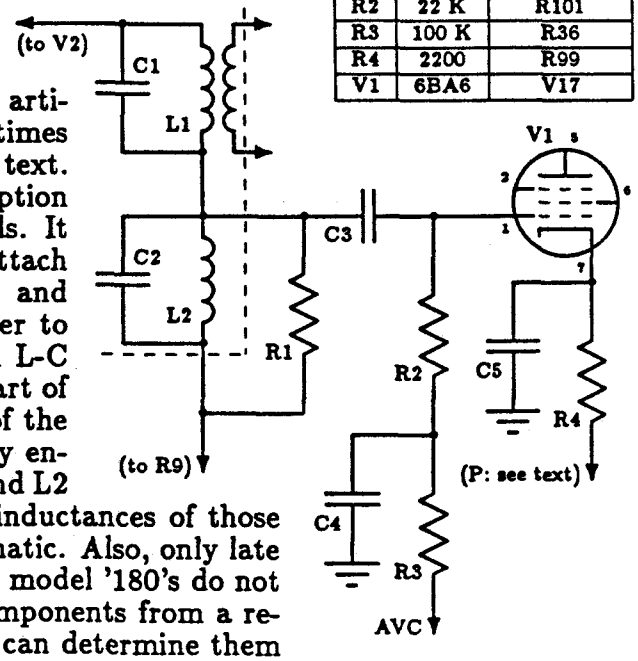
COLLINS DISC–WIRE MECHANICAL FILTERS, Part 3

DALLAS LANKFORD

Recall that in Part 2 (*HSN* **12**) I discussed the two general kinds of mechanical filter circuits which are used when AVC is needed at the output, namely series and parallel AVC. In Part 3, I will present some applications of those two general approaches, using suggested before and after circuits for some common tube type communucations receivers. Let me begin with a description of an HQ–180(A) mod which I have done to my own '180. A more detailed discussion of this mod is contained in *'180 + Collins F455FA40 Mechanical Filter = Super-'180* which may be ordered from the National Radio Club, Publications Center, P. O. Box 164, Mannsville, NY 13661, or you may order a 5 page revision of this article directly from me for $1 and a SASE.

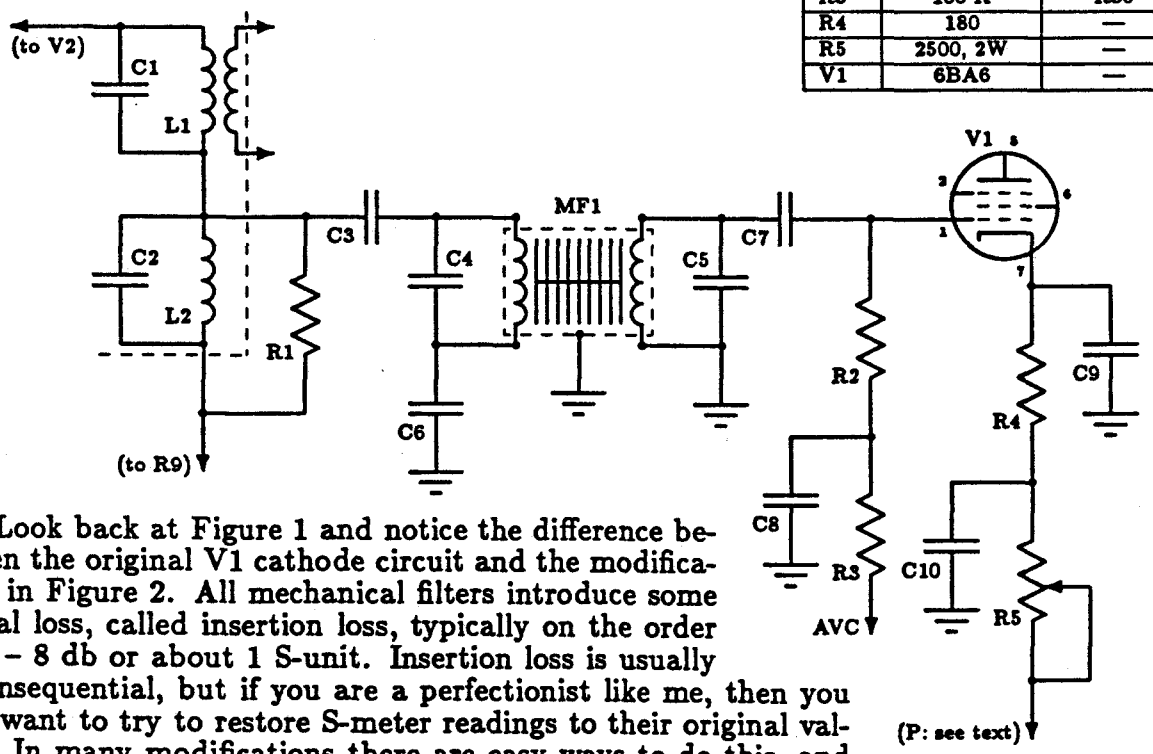
The format I will use to display schematics is illustrated in Figure 1, a small section of a late model HQ–180A schematic. The figure labels are not (usually) the same as '180 labels, which are listed in the column under "HQ–180(A)." To avoid ambiguity and confusion, when I refer to the labels from a receiver schematic I will enclose them in parentheses. For example, C3 in Figure 1 is (C134) on a '180 schematic. I have also deleted some details from the original schematics to conserve space and simplify schematics. For example, the original '180 schematic indicated that a shielded cable connected the junction of C2, L2, and R1 to C3. However, in all cases there should be enough details for you to associate the figures from this article with actual receiver schematics. Sometimes additional information will be given in the text. For example, Figure 1 contains the the caption "(P: see text)" beside one of the arrowheads. It would have been awkward or unsightly to attach the label "(to junction of R14, R15, R18, and C20)" at that point, and it is much simpler to refer to that point as point P. The parallel L-C tuned circuits L1-C1 and L2-C2 are both part of transformer T1, and I have omitted some of the shielding (dashed line) which should entirely enclose them. The question marks beside L1 and L2 in column 2 of Figure 1 indicate that the inductances of those two inductors is not given on the '180 schematic. Also, only late model '180's have C5 (C158) and very early model '180's do not have R1 (R107). The voltage ratings of components from a receiver schematic are not given because you can determine them

Figure 1		HQ-180(A)
C1	22	—
C2	90	—
C3	2	C134
C4	.01	C130
C5	.01	C158
L1	?	—
L2	?	—
R1	100 K	R107
R2	22 K	R101
R3	100 K	R36
R4	2200	R99
V1	6BA6	V17



from the original schematic or parts list. Voltage ratings of added components in modifications, such as in Figure 2, are generally given, except for half watt resistors whose ratings are omitted. The mechanical filter type (second column entry beside MF1) and resonating capacitors (second column entry beside C3 and C4) are not specified. Any FA, FB, or N series mechanical filter is suitable for any of these modifications. The values of the resonating capacitors Ct for each filter have already been given in Part 1 (*HSN* 11). If you have an older '180 which does not have R1 (R107), it is not necessary to add a 100 K resistor. I removed R1 (R107) from my '180 to determine if there was any noticable difference, but could detect none.

	Figure 2	HQ-180(A)
C1	22	—
C2	90	—
C3	.01, 1 KV	—
C4	Ct (see text)	—
C5	Ct (see text)	—
C6	.01, 1 KV	—
C7	.01, 1 KV	—
C8	.01	C130
C9	.01	C158
C10	.01, 1 KV	—
L1	?	—
L2	?	—
MF1	see text	—
R1	100 K	R107
R2	100 K	—
R3	100 K	R36
R4	180	—
R5	2500, 2W	—
V1	6BA6	—



Look back at Figure 1 and notice the difference between the original V1 cathode circuit and the modification in Figure 2. All mechanical filters introduce some signal loss, called insertion loss, typically on the order of 6 – 8 db or about 1 S-unit. Insertion loss is usually inconsequential, but if you are a perfectionist like me, then you will want to try to restore S-meter readings to their original values. In many modifications there are easy ways to do this, and the modified cathode circuit of Figure 2 illustrates one such method. Notice that R4 of Figure 1 has been replaced by R4, R5, and C10 of Figure 2. For reasons which I will discuss later, you should not replace R4 of Figure 1 by a 2500 ohm 2 watt variable resistor in an attempt to simplify the cathode modification.

The AVC feed for V1 of Figures 1 and 2 is parallel. Because R3-C4 of Figure 1 [R3-C8 of Figure 2] is part of the '180 time constant circuit, they should not be changed [and have not been changed]. The load resistor R2 has been changed from 22 K in Figure 1 to 100 K in Figure 2. Collins recommends load resistors of at least 50 K for FA, FB, and N filters. You may use any value in the 50 K – 500 K range.

The filter input circuit is not the same as recommended by Collins, partly because L1-C1 and L2-C2 are switched by the '180 depending on the band, making it difficult to design and construct an alternate circuit. Also, it makes no sense to unnecessarily remove parts while modifying a receiver. So the input circuit takes advantage of the existing 455 kHz IF transformer L2-C2, and is typical of many modifications except that R1 will usually not be present.

Figure 3 is a small piece of a SP–600 schematic showing the 455 kHz gate V1 (V7), the 3.955 mHz to 455 kHz converter V2 (V6), and part of T3, the 455 kHz IF transformer which includes a multiposition 455 kHz crystal filter. In contrast to the '180 modification which provides mechanical filter selectivity only for the low bands, bands 1 – 4, the modification of the SP–600 in Figure 4 provides mechanical filter selectivity for all bands. Assuming there is ample space inside the SP–600 chassis near T3, the Figure 4 modification should be especially easy. It only requires disconnecting the B+ line at the junction of C3 and R1 in Figure 3 (never having seen a SP–600, I am not sure where C10 attaches to the B+ line ..., you may be able to use C10 in place of C2 if it attaches appropriately), and disconnecting the wire which joins the junction of V1 and V2 pins 5 and the junction of L1-C1 of Figure 3. The modification in Figure 4 requires a mechanical filter of your choice (I like the N series), a 10 mH 100 mA choke (you can cannibalize a nice 12 mH choke from an R–390A IF subchassis), a 2200 ohm half watt resistor, five .01 1KV disc ceramic capacitors, two filter resonating capacitors Ct [C3 and C4], some stranded hookup wire, perhaps a few short pieces of coax, a little aluminum metal or printed circuit board work to fabricate a mounting arrangement for the filter, and you are in business. A similar modification could also be done to the '180 because it uses a similar conversion scheme [following V1 of Figure 1]. The only differences are the '180 high IF is 3.035 mHz [which does not affect the modification], the bypass capacitor C9 and dropping resistor R2 of Figure 4 are outside the '180 IF transformer, and the '180 has no bypass capacitor corresponding to C10 in Figure 4. The main reason I did not do a Figure 4 style modification on my '180 is because I wanted a mechanical filter immediately following the first mixer for best BCB performance.

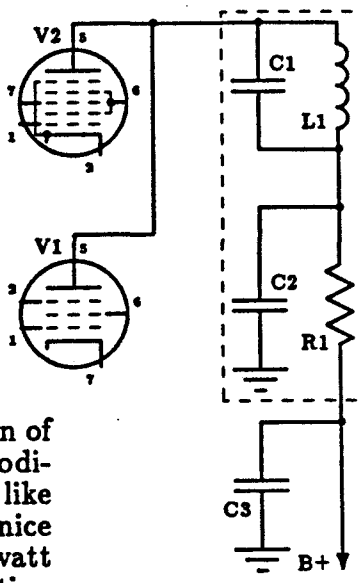


Figure 3		SP–600
C1	220	C107
C2	.022	C108
C3	.022	C109
L1	?	L36
R1	2200	R41
V1	6BA6	V7
V2	6BE6	V6

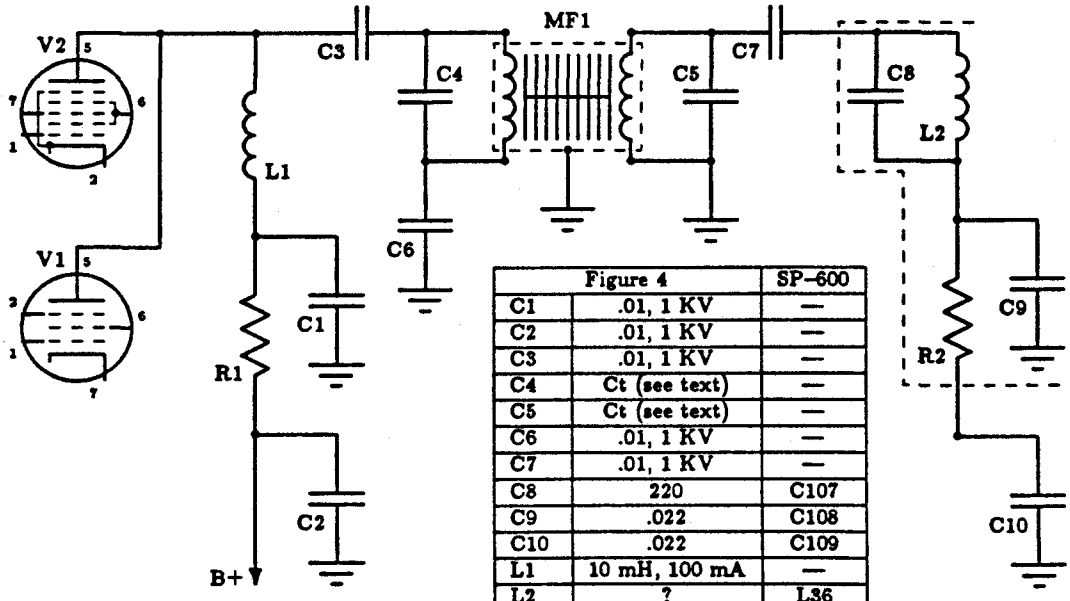


Figure 4		SP–600
C1	.01, 1 KV	—
C2	.01, 1 KV	—
C3	.01, 1 KV	—
C4	Ct (see text)	—
C5	Ct (see text)	—
C6	.01, 1 KV	—
C7	.01, 1 KV	—
C8	220	C107
C9	.022	C108
C10	.022	C109
L1	10 mH, 100 mA	—
L2	?	L36
MF1	see text	—
R1	2200	—
R2	2200	R41
V1	6BA6	V7
V2	6BE6	V6

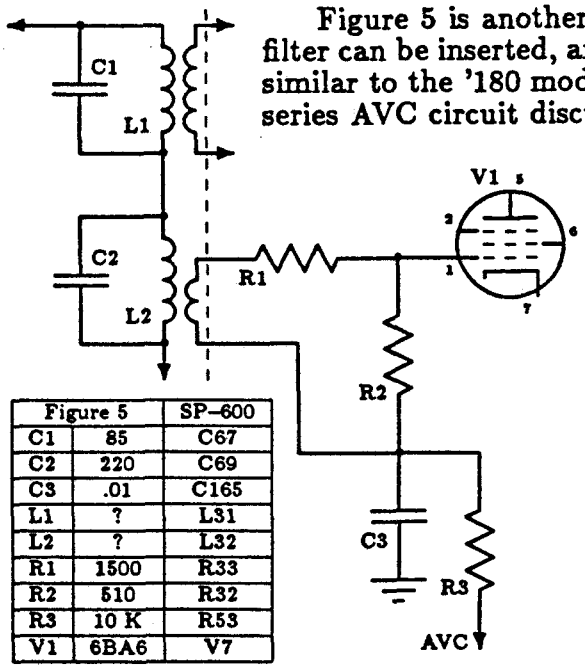


Figure 5		SP–600
C1	85	C67
C2	220	C69
C3	.01	C165
L1	?	L31
L2	?	L32
R1	1500	R33
R2	510	R32
R3	10 K	R53
V1	6BA6	V7

Figure 5 is another part of a SP–600 schematic where a mechanical filter can be inserted, and Figure 6 below shows the modification which is similar to the '180 modification in Figure 2. Figure 6 also illustrates the series AVC circuit discussed in Part 2 (*HSN* 12). It requires a bit more "surgery" than the Figure 4 modification, but has the advantage (or disadvantage, depending on your point of view) of placing the mechanical filter immediately after the first mixer. Similar to the '180 modification, the Figure 6 modification provides mechanical filter selectivity only for the low bands, bands 1 – 3. I have not done the Figure 6 modification, so I do not know how difficult it may be to access the junction of L1-C1 and L2-C2. I would appreciate receiving a letter from any reader who does this modification concerning the difficulty or ease of accessing the junction of L1-C1 and L2-C2, and any other points about this modification so that I can include additional information in future revisions. Notice, too, that both R1 and R2 should be removed, and there should be no components connected to the output link coupling of L2 (L32). The Figure 6 modification is different from the '180 modification in another important way. In both cases, signal loss is intentionally introduced before the "gate" [V1 (V17) of Figure 1 and V1 (V7) of Figure 5] because an IF amplifier [which the "gate" essentially is] has more gain than a converter [which is used in place of the "gate" for the high bands signal path]. But the methods of introducing signal loss are different, cf. Figures 1 and 5. Having no direct experience with a SP–600, I do not know what effect the mechanical filter modification in Figure 6 will have on net signal level loss or gain for the low bands signal path. In other words, I cannot predict whether the sum of the mechanical filter insertion loss plus the gain from eliminating the impedance mismatch at the grid of V1 (V7) in Figure 5 will be positive or negative. In the best of all possibilities, the loss and gain would exactly cancel, requiring no further circuit changes. If the net effect is a loss, I will describe a simple solution later which is also applicable to the modification in Figure 4. If the net effect is a gain, then gain reduction should be applied to the gate, and I will describe a simple solution later which uses a circuit borrowed from the '180. Perhaps it is appropriate here to give an important ***WARNING***: impedance mismatching should never be used at either the input or output of a mechanical filter because it may [and usually will] cause all kinds of anomalous performance, including *greatly* increased insertion loss, possible spurious responses such as harmonic and intermodulation

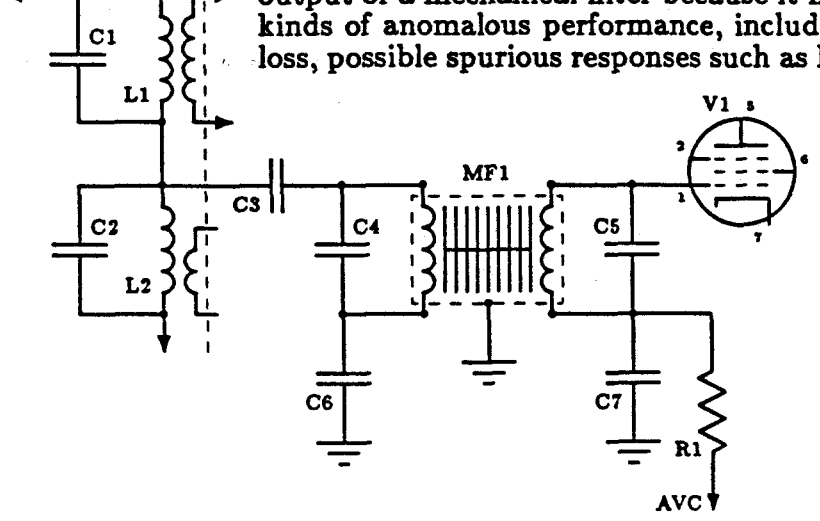


Figure 6		SP–600
C1	85	C67
C2	220	C69
C3	.01, 1 KV	—
C4	Ct (see text)	—
C5	Ct (see text)	—
C6	.01, 1 KV	—
C7	.01	C165
L1	?	L31
L2	?	L32
MF1	see text	—
R1	10 K	R53
V1	6BA6	V7

distortion, *greatly* increased pass band ripple, and *greatly* reduced stop band rejection. If the thought of removing and opening up T2 to find the junction of L1-C1 and L2-C2 blows your mind, not to mention the potential problem of rewiring T2 to bring a lead from the junction to a lug on the base of T2 so that you can access the junction, then you might like to consider an alternate approach below in Figure 7. As I have indicated above, the problem with connecting a mechanical filter between the grid of V1 and the junction of R1 and R2 of Figure 5 is the resulting impedance mismatch which would probably cause all sorts of anomalous filter performance. But did you know that FA and FB (and probably N) series mechanical filters can be tuned in two ways — parallel and series? The parallel tuning is generally found in most production circuits, and in fact I have never seen the series tuning used in practice (it is mentioned briefly in Collins data sheets for the FA and FB series filters). Parallel tuning is used for loads of 100 K ohms or more, which is perfect for tube plates and grids, and for high impedance parallel L-C circuits such as in the previous examples. Series tuning is used for loads of 500 ohms or less, which would seem ideal for the 510 ohm load presented by R2 of Figure 5. Never having tried it, I can make no promises for the modification of Figure 7. If anyone checks it out, please drop me a line.

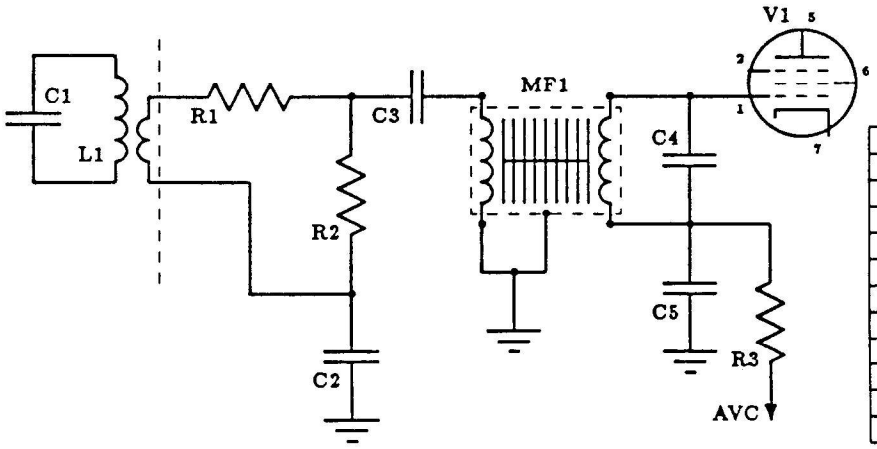
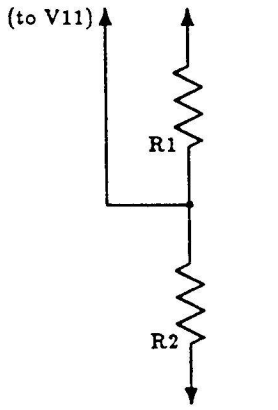


Figure 7		SP–600
C1	220	C69
C2	.01, 1 KV	—
C3	Ct (see text)	—
C4	Ct (see text)	—
C5	.01	C165
L1	?	L32
MF1	see text	—
R1	1500	R33
R2	510	R32
R3	10 K	R53
V1	6BA6	V7

As I said above, for the SP–600 there is a simple way to compensate for any reasonable (5–10 dB) insertion loss introduced by a mechanical filter. Figure 8 shows the method: unsolder the wire at the junction of R1 (R95) and R2 (R96), remove R2 (R96), and replace it with a 25 K, 2 W variable. The R1-R2 circuit is a voltage divider which provides about −10 VDC for the grid of V11, thus substantially reducing the gain of V11. This is the same principle used for AVC, except that the AVC voltage varies depending on signal level. Just as a guess, the modification in Figure 8b may permit an additional 20 dB gain from V11, which is much more than should be needed. The 25 K, 2 W variable resistor can be mounted almost anywhere you please as long as you don't run the connecting wire near RF, mixer, oscillator, and IF stages which precede V11 in the signal path. Because variable resistors are notorious for promoting anomalous performance as they age, the best approach is to replace R2 with two fixed resistors soldered in place.



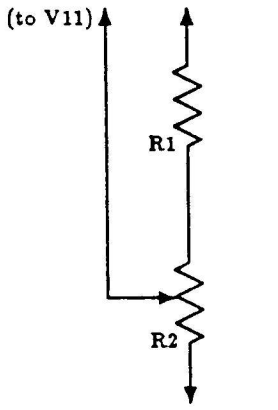


Figure 8a		SP–600
R1	82 K	R95
R2	22 K	R96

Figure 8b		SP–600
R1	82 K	R95
R2	25 K, 2 W	—

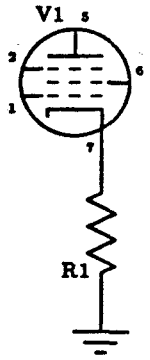


Figure 9a		SP–600
R1	390	R112
V1	6BA6	V7

The final circuit in this collection of SP–600 mechanical filter modifications is a gain reduction method for the "gate." Figure 9a shows the original V1 (V7) cathode circuit, which is similar to the method used in older '180's. Look back at Figure 2 and you will see that the circuit of Figure 9b is essentially the same as the one which works well in my '180 modification. The circuit in Figure 9b should allow up to 20 dB of gain reduction, i.e., about 3 S-units. Like the modification of Figure 8b, the best approach is to replace R1 and R2 in Figure 9b by a fixed resistor after the required value (180 ohms plus the experimentally determined value of R2) has been determined. The bypass capacitor C2 is desirable to minimize stray signal paths while both R1 and R2 are in use because it will probably be necessary to mount R2 some distance away from pin 7 of V1 (V7). At this point it is perhaps appropriate to say that the Figure 9b modification is intended for use only with the Figure 6 or Figure 7 modification, while the Figure 8b modification is intended for use only with the Figure 4 modification.

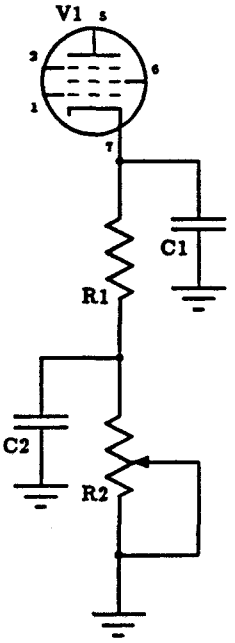


Figure 9b		SP–600
C1	.01, 1 KV	—
C2	.01, 1 KV	—
R1	180	—
R2	2500, 2 W	—
V1	6BA6	V7

There a several points to consider before you rush off and add a mechanical filter to your SP–600. First, which filter series and what band width will you choose? If you never listen casually, and only DX, then I suppose a 2 kHz band width filter is the logical choice. But I presume you have considered that a 2 kHz band width significantly reduces fidelity. A good compromise is a 4 kHz filter, which I used for my '180 modification, but I missed the wider band widths enough to have caused me to begin preparations for a switched mechanical filter arrangement for my '180. That is not as difficult as you might think, because an R–390A IF subchassis contains all the parts necessary for such a construction project. Second, you will not be able to use the SP–600 crystal filter narrow band widths (1.3, 0.5, and 0.2 kHz) unless its center frequency just happens to be very nearly 455 khz. To avoid an unpleasant surprise later, measure the crystal filter center frequency before you start . An off-frequency crystal filter will not stop the determined experimenter, who will trade crystals until the center frequency is acceptable. An R–390A IF subchassis contains a crystal filter with a 455 kHz crystal which may suffice. Third, where and how will you mount the mechanical filter and its associated components? In my experience it takes about the same amount of work to develop a satisfactory mounting arrangement for both the FA/FB and N series filters. In both cases be sure that a grounded metal shield is placed between the input and output terminals (including all associated components such as Ct's and leads. If it is not possible to isolate parts of the leads, double shielded cable may be required to avoid degrading filter stop band performance. Fourth, if you do the modification in Figure 6, give some thought to opening up transformer T2 for access to the junction of L1-C1 and L2-C2. Assuming T1 has a "quick release" shield style and there is enough nearby empty space, it may be possible to modify T1 *in situ*, without removing the entire transformer assembly from the chassis. But do not hesitate to remove the entire transformer assembly if it is necessary.

The HQ–150 is another receiver in the Hammarlund line which can be fitted with a mechanical filter. Figure 10a shows part of the first IF transformer (T1) and the AVC and input to V1 (V4). The '150 modification in Figure 10b is similar to the Figure 6 modification in that you will have to remove the IF transformer shield and rewire the output. I have not done this modification, but reports of a similar modification to a HQ–129 indicate that the increased signal level due to modifying L1 approximately compensates

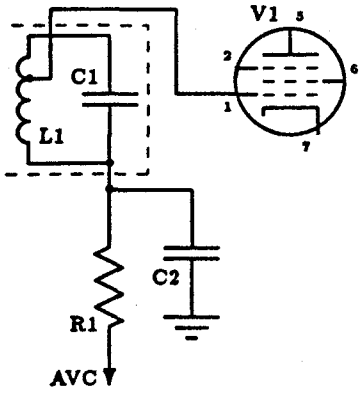


Figure 10a		HQ-150
C1	260	C11
C2	.02	C12
L1	?	not labeled
R1	10 K	R10
V1	6BA6	V4

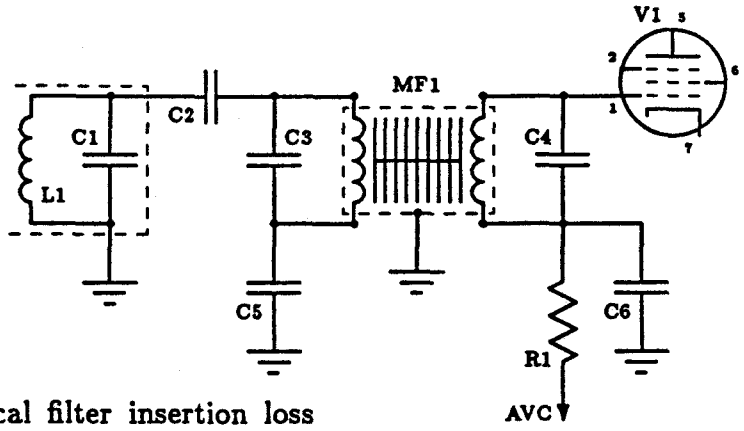


Figure 10b		HQ-150
C1	260	C11
C2	.01, 1 KV	—
C3	Ct (see text)	—
C4	Ct (see text)	—
C5	.01, 1 KV	—
C6	.02	C12
L1	?	not labeled
MF1	see text	—
R1	10 K	R10
V1	6BA6	V4

for mechanical filter insertion loss which should make additional modifications unnecessary. However, if a net signal level gain is experienced after adding a mechanical filter, the gain-reduction modification in Figure 9b may be used at the cathode of V1 (V4) in Figure 10b. And, if a net signal loss is experienced, the the inductor in T3 can be modified like L1 of Figure 10b. Apparently it may require modifications to both T1 and T3, and, in addition, a gain-reduction modification to the cathode of V1 (V4) to restore the '150 gain distribution.

PUBLISHER'S CORNER

So what does your intrepid publisher do when he gets the first draft? Well, obviously, I read it and try to find any spelling or other errors. I also make suggestions about style and layout. Then I write the Publisher's Corner, and return the draft to Dallas who produces a camera-ready copy. For this issue, the corrected and final draft arrived back in Ruston about October 14. When I receive the camera-ready copy several weeks later, I take it to Pioneer Printing on 36th Street and Eighth Avenue, Manhattan for prompt printing of 200 copies. Afterwards, I sort the mailing list in my company's computer, delete those whose subscription expired two issues before the current one, and send a personalized letter to those whose subscription expired with the previous issue. Then I print the address labels, collate and staple each copy, and attach labels to the envelopes which are also printed by Pioneer Printing, and are quite striking, I think. Next I stamp the envelopes, rubber-stamp the renewal issues, fold, insert, and seal each newsletter, and trek across Webb Avenue in the Bronx to drop 130 finished newsletters in a mailbox. Finally, I sit back, sip a Manhattan, and declare the job well-done.

Speaking of jobs well-done, Dallas asked me to thank the 10 – 15 individuals who responded during the month of September to our appeal for material. We are very pleased with the results. That doesn't mean that the rest of you can sit on your *tokuses*. We still need material if *HSN* is to continue to be published regularly. The current supply of material may be *barely enough* for winter and spring 1987 issues.

 Prices quoted below the masthead apply to U.S.A., Canada, and Mexico – double all quoted prices for other areas. Checks must be payable to Chris Hansen and must be in U.S. funds payable in U.S. clearing house format. Write for an information sheet – it's available for a SASE.

THE HOLLOW STATE NEWSLETTER

SPRING 1987 No. 16

SUBSCRIPTIONS: $4 for one year (4 issues). BACK ISSUES: $1 each, numbers 5–15 currently available. SELECTED REPRINTS: The best of *The Hollow State Newsletter* from numbers 1–4, $2.75. PAYMENT: Send check or money order payable to Chris Hansen, address below.

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CONTRIBUTING EDITOR'S CORNER

Skip Arey

You might ask yourself ... How is your humble editor able to bring you all this technical wonderfulness armed only with a BA in Sociology and a Master of Divinity, as opposed to a BSEE or even a certificate from Lincoln Tech?

The answer is simple, bukaroo. All that book learnin' in the humanities taught me that knowledge is power. So when I set my sights on becoming an SWL legend, I simply went out and bought a large dose of knowledge. And here's the kicker ... You can do it too! A trip or two to the bookshelf and you will be able to venture into the wonderful world inside your radio. The neat thing about technical topics is that technical material can usually be presented in a logical manner that lends itself to easy discovery by the uninitiated. And technical stuff becomes all the easier when you discover that you don't really need *everything* an electrical engineer learns. Only a few selected chapters and you are on your way. You won't be able to design you own receivers, but you will be able to diagnose most troubles and even fix some things yourself. This is my lead in for ...

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Uncle Skip's Guide To Electronic Knowledge or Books You Can Use

Electronic Communication
by Robert L. Shrader

If you can only afford one book in your radio library, this is the one to have. Shrader's work has long been acknowledged as the best single text which can lead you to an understanding of radio. I know several folks who have used this book alone to master the knowledge necessary to acquire a FCC First Class Radiotelephone License. Just pick it up, start on page one, and by the end (with help from little quizzes spaced throughout the book) you will have enough information to pass most amateur exams and sink all but the professional engineers on radio theory. Also, the book's table of contents is set up in a manner that makes it easy to look up individual subjects as needed. Shrader's book is definitely the standard by which all others are judged. I have the fourth edition which suits me just fine, but if Bob is out there reading this, I think this well-deserved plug is worth a copy of his latest edition. Don't you? The book is published by McGraw Hill's Gregg Division, ISBN 0-07-057150-3.

Radio Handbook
by William I. Orr, W6SAI

As the call sign indicates, Bill Orr is a radio amateur. Bill's book, which is in its twenty-third edition, is best known for its antenna theory, but the book is a great source of overall information geared toward the amateur and experimenter. Chapter 13 even includes construction details for a high performance communications receiver. The book is published by Howard W. Sams & Co., a division of Macmillan, Inc., ISBN 0-672-22424-0.

The ARRL Handbook For The Radio Amateur
by The American Radio Relay League

This is probably the most accessible of the useful books in that you can frequently pick up a used copy for a song at almost any hamfest. It has been published for the last sixty-three years, and generally changes slowly, so you don't absolutely need the most recent edition. Each new addition adds just enough new information to make many serious experimenters buy one, but the casual user will be just as happy with the 1984 edition. As most of you know, I am very wrapped up in some old tube type gear. Consequently, I seek out positively antique issues of the handbook. In fact, I would be lost without my 1960 edition. The book is published by The American Radio Relay League, ISBN 0-87259-062-3. [Various editions of this are among my favorites. I have the '79, '77, '72, '62, and '58 editions, plus four or five others available at the local university library. Ed.]

The Complete Handbook Of Radio Receivers & Transmitters
by Joseph J. Carr

If you want to understand your rig, and do serious troubleshooting and repairs, you must add this book to your collection. Originally published in two volumes, it is now available bound in a single volume. It covers all areas of radio theory, taking the reader through the guts of some of the most popular current equipment. The book shows you how to use test gear to bring your tired and broken equipment back into good operating condition. Also, Carr makes some very difficult subjects understandable to the rank novice. The book is published by TAB Books, Inc., ISBN 0-8306-8224-4.

Semiconductor Replacement Guide
by Radio Shack

Every now and then a part will go phhfffiiittt!!! When this happens, Murphy's Law always indicates that the original replacement part is only available from a camel trader in Swaziland. Thus, enter the Semiconductor Replacement Guide ... Actually, you can use anybody's replacement guide, but Radio Shack's is perhaps the easiest to find. If you are interested in tube gear, you will need to scour the hamfests for an old tube substitution guide. Radio Shack used to sell a reasonably good one, catalog # 276-4009.

To order these books, go to your local book dealer and ask for his assistance in ordering. It is probably a good idea for the book dealer to check that the books are still available by consulting a current edition of *Books In Print.* [If you are near a good university library, you may be able to read most of these book for free, or for no more than the price of a library card if you want to read them leisurely at your home or apartment. Ed.]

One final point. If you have not written the manufacturer of yout receiver or transmitter to obtain the factory repair manual, you are a very silly person. Even if you never intend to lift the cover of your rig yourself, you will find that this is a very useful [essential Ed.] document to have around when repair or alignment become necessary. If you do intend to repair or modify your gear, you will find such documents invaluable. You can often obtain schematics and service data for older or out of production gear through Howard W. Sams Photofacts system. Ask your local TV repair person about how to get Photofacts. [Any serious radio nut, like me, *must* have the factory manual for any piece of gear I keep. Ed.]

SHORT CONTRIBUTIONS

SP–600 CAPACITORS: The SP–600 is famous for its large quantiry of black tubular capacitors, which in turn are famous for developing leaks and shorts. A few years ago when my SP–600JX–21 "died" I traced the trouble to a shorted black tubular bypass capacitor in the RF module. After reading the manual and seeing what a job it would be to replace it, I decided to replace all the tubular capacitors. I don't remember exactly how many there were of each value (.01 and .022 mfd), but the local parts dealer gave me a quantity discount! I replaced every single one, including those in the coil assemblies on the turret, and inside the 3955 kHz IF "can." *Every* capacitor I took out was either leaky or shorted, and some had split open. I paralleled two .01's to replace each .022's. It was necessary to remove the front end deck, selectivity switch, and 3955 kHz IF transformer shield to get at them all. [A partial SP–600 schematic that I have shows more .022's and a .01 inside T1, T3, T4, and T5, but maybe they are not the infamous black tubulars. Ed.] This project took an entire weekend, but was well worth the time and effort. After realignment, the SP–600 was equal to or better than new specs, and dial accuracy is limited only by my eyesight. I also added a product detector – IC, not tubes [Gasp! Ed.] – and ended up with a superb receiver for both AM and SSB. If anyone wants more information about these jobs, send me a SASE: 17 Elmer Ave., Bernardsville, NJ 07924, or call (201) 766-6181 between 1730 and 2100 Eastern time. (Robert W. Kulow, WA2UEH) [Thanks for the tip on the bad black tubular capacitors. Ed.]

SP–600 RYDER'S MANUAL & ALIGNMENT: I have a copy of John Ryder's manual for the SP–600 if anyone needs a copy. Send me a SASE for details: 154 Intervale Rd., Mountain Lakes, NJ 07046. I got mine from McMahon in CA [full name and address? Ed.] They have an excellent library of service manuals for sale as well as *Flick Of The Switch* and other books on early radio. I have just finished aligning the SP–600 and I can tell you it is a very ticklish and tedious job. You must have an accurately calibrated signal generator that does not drift. An alternative to accurate calibration and stability which I used is to monitor the signal generator frequency with an accurate, stable frequency meter,

preferably digital. Each alignment step must be repeated several times to get best results which is why accuracy and stability are necessary. (Timothy Walker)

51H & 51N: Regarding a question from *HSN* **13**, in *The First 50 Years - A History Of Collins Radio Company And The Collins Division Of Rockwell International*, there is a seven page list of all Collins products which is not entirely accurate or complete. The 51N-1 is listed there as a fixed tuned HF receiver introduced in 1946 and continued through several production changes to the 51N-5 in 1951–2. No 51H product is listed. The first receiver produced by Collins was the 51Q, a seven tube set covering 1.5–12 mHz in four bands, operated from 12 VDC, made for the military about 1940–44. I am presently completing a book on vacuum tube communications receivers which lists every set from 1931 to 1975, along with a history of the 51 USA companies which manufactured them. My book includes 33 models and variations under Collins alone, and over 675 receivers altogether. It should be available later this year. (Ray Moore) [Please send us more details about your book, such as price and how to order, when it becomes available. Ed.]

R–390A STAND BY: The Operator's Manual, TM 11-5820-358-10, warns on page 24 not to leave the R–390A in STAND BY for more than 30 minutes becuase the life of certain tubes may be shortened. (Bruce Winkelman) [Thanks for sending me this information, Bruce. I also have the operator's manual, yet somehow had never noticed the warning. And many of us have read or heard this warning before, but I don't recall seeing the specific reference to TM 11-5820-358-10 before. If I have read the R–390A schematic correctly, the "certain tubes" above refers to the PTO tube and the audio tubes. I have also discovered that the nominal 240 (RF and IF) and 205 (audio) VDC lines have considerably higher voltages under various signal levels and function settings (STAND BY/AGC/MGC/CAL). The highest voltages occur in STAND BY, namely 271 and 256 VDC respectively for one of my units with a solid state power modification and recommended 200 ohm dropping resistor. This means the 205 VDC line is about 51 volts high, while the 240 VDC line is about 31 volts high when on STAND BY. The potential damage to RF and IF tubes, except the PTO tube, is not great because the function switch turns off the nominal 240 (= 271) VDC line to most RF and IF tubes. But the audio line is not switched, so all audio tubes are operated at 256 VDC when on STAND BY. The audio output tubes are operated far beyond their ratings, which undoubtedly contributes to their reputation for frequent failures. Incidentally, without the 200 ohm dropping resistor, the RF B+ line can easily exceed a whopping 300 VDC. All of these unhappy facts have caused me to reject the solid state power supply conversion, and unmodify my R–390A's back to twin 26Z5W rectifiers. I'll repeat what Al said two issues ago: hollow state forever! Ed.]

3TF7 SUBSTITUTE: The 3HTF4 is equivalent to the 3TF7 and Don Roller, 3983 Pine View Lane, Greenwood, IN 46124, (317) 882- 0410 has a supply of new 3HTF4's. (Charles Taylor)

HAPPY HC–10 OWNER: I advertised for an HC–10 in the Yellow Sheets and AM Press/Exchange, got several replies, and bought one. The asking price seems to be around $50. Now that I have used and HC–10, I think it is a must for the R–390A or similar receiver. I connected my HC–10 to the R–390A via a supplied adapter cable and socket which plugs into the 4th IF tube socket. Thinking it would be neater if I used the R–390A IF output jack, I later tried that arrangement [which requires that you homebrew a connecting cable with a BNC plug on one end and an RCA jack on the other, or some similar arrangelent with adapter plugs of various kinds Ed.]. However, when using that arrangement, signals were attenuated so much that I returned to the original method. There could be a problem with the IF output of my R–390A; I don't know. [Are you sure that your R–390A cathode follower tube was not bad? Also try checking all of your cathode follower tube pin voltages and resistances. I connect my HC–10 to my R–390A IF output jack and it performs great ... essentially just like my HQ–180A. Ed.] I certainly have been enjoying using the HC–10. The selectivity choices seem better suited to shortwave listening than

those of the stock R–390A. I also listen to CW quite a bit, and so appreciate the 500 kHz position. On the other hand, I miss the R–390A sharp audio filter which is eliminated when using the HC–10. My favorite HC–10 feature is selectable sidebands in AM mode. Nifty! (Jay Mathisrud)

R–390A MINIATURE COAX: Regarding the R–390A IF output jack, the miniature coaxial cable has cracked outer insulation, so it could be cracked on the inside, too. Does anyone know the nomenclature, specifications, and a source for this miniature coax which is use for many other connections in the R–390A. (Jay Mathisrud) [Yep. It is RG-187U according to the NAVSHIPS 0967-063-2010 technical manual. If you ever find any, please let me know. I finally got tired of looking at the cracked insulation and frayed shield on one of my PTO's, so I bought some RG-187AU. The main difference is that the U type has a solid center conductor, while the AU has a stranded center conductor. If memory serves me correctly the RG-187AU is rated as 95 ohms nominal and about 20 pf capacitance per foot. One problem I encountered is that you can only purchase a 100 feet minimum of RG-187AU, which came to about $100. It is very high quality mil spec: the center conductor is 7 strands of silver plated #38 steel wire, white teflon insulation, silver plated stranded shielding, with two layers of white teflon tape outer insulation. The center stands are *very* easy to cut or break while "dressing" the cable for use, and it helps to use a magnifying glass while you count center strands to make sure you haven't cut any while removing the center insulation. It weighs 1/5 ounce per foot. Ed.]

R–390A NOSTALGIA: I have modified, rebuilt, and sold these receivers for the past ten years. As you may know, the U. S. Navy still uses R–390A's on ships larger than a frigate – solid state doesn't work well on these ships because of the high RF fields which cause front end overloads. I have owned R–390A receivers manufactured by 10 different companies, and I understand they were made by 13 different contractors. The last Collins contract was in 1955. I have a manual on this receiver dated 1972, but the receiver was called R–725/URR, which is a NSA version. Many of the NSA versions have an entirely different IF strip which has yet to be seen on the surplus market. There is also another version manufactured by Manson Labs called the R–1230 or something like that. I have more or less dropped out of the rebuilding business because you just can't get very much for R–390A's nowadays, but I still have a good supply of parts. (Walter Chambers)

TUBE TESTERS: The manager of my local Radio Shack received a memo from Tandy HQ in Fort Worth telling her to dispose of their self-service tube tester (Mercury model 204). Tandy has decided that the testers are under used and taking up valuable display space. The manager tried to sell the tube tester for two weeks, asking $50, but had no takers, and was prepared to pay a scrap dealer to get it out of the store. Being in the right place at the right time, I ended up with the tester and $10 in my pocket. The one I got was in excellent condition, and just needed a little cleaning. Check with your local Radio Shack and see if they still have one in the back room which they want hauled away. The manager assured me that Radio Shack will continue to sell tubes. (Frank Orcutt) [Thanks for the tip, Frank. Unfortunately my local Radio Shack had already disposed of their tube tester by the time your letter arrived, and then *HSN* 16 was delayed due to my computer problems, so most of our readers may miss this opportunity for free gear. Generally I do not place much faith in the results of tube testers because I have personally observed that they sometimes indicate good tubes are bad and vice versa. In my opinion, the only reliable use for a Radio Shack tube tester is to identify *very* bad tubes for discarding. But I used them frequently enough for this purpose that I decided to invest in a tube tester. My selection was a TV-10A/U tube test set which I purchased from Fair Radio in checked condition for $79.50 plus $10 for the manual and $7.50 for supplemental test data. The unit is housed in a small metal suitcase, which makes it portable, and it operates from 120 VAC power. There were, however, a number of problems. The manual (copy) was incomplete, missing the parts list with components values, and the schematic included

with the manual did not list the values of all components. After inspecting the unit, naturally it was found that some repairs had been made, and some of the parts replaced were those without values on the schematic. Fortunately, Fair Radio apparently had an original complete manual and at my request sent me a copy of the parts list which includes all component values. It is still somewhat annoying to receive an incomplete manual which was not advertised as such. The problems did not end there. One of the lamps (a # 45 lamp used to test for shorts) was an incorrect value, and the main tube (a rather expensive 83 tube at $7.50) had been replaced with a 5Z4 which my tube substitution book does not show as equivalent to an 83. Fair Radio did not take care of these problems, so apparently I will be out additional expenses. A rather sloppy replacement of a full wave bridge rectifier required the solder work to be re-done, and a lost screw which had bolted one side of one of the tube sockets to the front panel had been replaced with an oversized screw but no bolt – the mounting hole through the tube socket flange had been used as a bolt, if you get my meaning. Because of high wiring density around the tube socket, it was non-trivial to replace the screw with a correct screw and bolt. If that weren't enough, the tube socket contacts were so spread apart that tube pins did not make good contact, causing intermittent loss of meter readings. So I got out my dental probes and carefully bent all of the tube socket contacts back together. I do not know if this problem was a result of *much* use or abuse. On the plus side, the TV-10A/U is considerably more sophisticated than any tube tester I have previously used, and in theory permits the user to do precision tests and measurements on a tube. For openers, you can measure tube transconductance (also called mutual conductance) in micromhos on a large, accurate meter, in four ranges: 0 – 3000 / 6000 / 15,000 / 30,000. A roll chart contains most commonly used miniature seven and nine pin tube data, including minimum acceptable transconductance. There is a gas test, and a multi-step noise test which includes connecting the TV-10A/U to the antenna and ground posts of any radio receiver. I wonder if the manual really means *any* receiver? You can also test rectifiers (they don't have transconductance ... a calibration line on the meter determines minimum acceptable rectifier condition). The manual section on corrective maintenance appears satisfactory, although I have not actually used it yet. If you buy one, and I am quite satisfied with my TV-10A/U, be sure to get the supplementary test data, a 23 page listing of test data for older tubes not listed on the TV-10A/U roll chart. Every tube I have on hand is included on the roll chart or in the supplementary test data, including some old 2.5 volt filiment, double digit tubes such as the 27, 35, 45, and 47. Hopefully, some of you will be able to take advantage of Frank's tip and pick up a free tube tester. I would have gladly taken one, as the local Radio Shack tube tester has served my needs adequately since 1977. On the other hand, the TV-10A/U is a more elaborate piece of equipment, and may appeal to those who want or need a more precise tube tester. According to the manual you can even test the reserve life of a tube, which supposedly indicates a high probability that a tube will operate satisfactorily under adverse conditions due to low filament voltage (which may be caused by low power line voltages). Ed.]

EDITOR'S CORNER

To those that I owe letters, please be patient. After two months a supplier has yet to ship me a toner cartridge for my laser printer, and still has my money. Then one of my hard drives went out last month. While I had backup, it has still been quite a chore to repair and restart my system ... but that's another story.

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THE HOLLOW STATE NEWSLETTER

FALL 1987 No. 17

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EDITOR'S CORNER

Well, vacuum tube lovers, as you no doubt have concluded, *HSN* has gone to an irregular publication schedule. I had the best of intentions at the beginning of the summer to produce a summer issue, but considerable traveling during the months of June and August, and an unexpected heavy work load interfered. Please consider that we produce *HSN* in our spare time and for no pay, and that sometimes our real jobs take precedence. There seems to be enough material on hand for a few more issues, so we are not in immediate danger of running out of things to publish. But you should still sit down and write us a card or letter with some useful or interesting information for the newsletter. Remember, this is your publication, and exists only if you send us material for publication. Here is a suggestion which should be worth at least ten letters. Many of you use accessories with your hollow state receivers, such as loop antennas, VLF converters, audio filters, and so on. I'll do my part with a future contribution on my experiences with a two foot square, balanced, air core loop, and several balanced amplifiers.

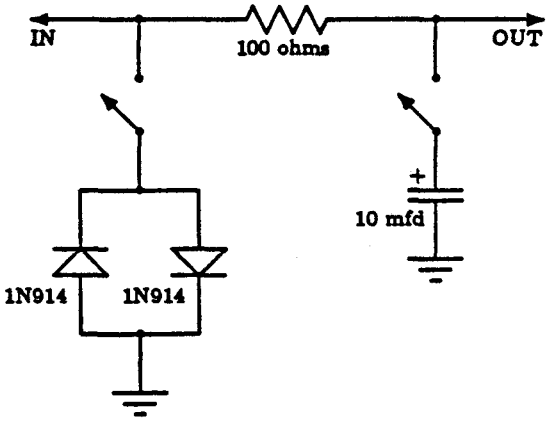
This document was produced with an IBM PC AT and a Cordata LP–300 laser printer using software developed by Personal TEX, Inc.

SHORT CONTRIBUTIONS

R-390A EXTERNAL AGC: On page 15 of TM 11-5820-358-20 we find "For external AGC, remove the jumper from AGC/NOR terminals 3 and 4, connect the negative terminal of the AGC source to terminal 4, and the positive terminal of the AGC source to terminal 7 (ground)." Apparently this would be one way to connect two R-390A's for diversity reception. (Dallas Lankford)

SP-600 BLACK TUBULAR CAPACITORS: The SP-600 is famous for the large quantity of black tubular capacitors in its circuitry. These capacitors are, in turn, famous for getting leaky and shorting out. A few years back. my SP-600JX-21 died, and I traced the trouble to a shorted bypass capacitor in the RF module. After reading the manual, and seeing what a job it would be to replace, I decided to expend a little additional effort and replace all of them , including those in the coil assemblies on the turret and inside the 3955 kHz IF can. I don't remember exactly how many there were of each value (0.01 and 0.022 mfd), but the local parts dealer gave me a quantity discount! My approach turned out to be correct because every capacitor I took out was either leaky or shorted and some had actually split open!! I used 0.01 mfd disk ceramic capacitors, and paralleled two of them to replace the 0.022's. It was necessary to remove the front end deck, selectivity switch, and shield on the 3955 kHz IF can to get at all of them. After replacing all the black tubulars, I carefully aligned the SP-600, and it now works like new. (Bob Kulow)

8 OHM HEADSET MOD: Here is a tip about using 8 ohm headsets with 2000 ohm headset outputs of tube type receivers. I didn't have a matching audio transformer on hand, so I added a 100 ohm half watt resistor in series with the headset output line. The resistor dropped the audio output enough to eliminate hum in the audio. I also used a 10 mfd 25 VDC capacitor from the "hot" side of the audio on the headphone side of the 100 ohm resistor to ground which acts like an audio filter and attenuates audio frequencies above 4000 Hz. Then in front of the 100 ohm resistor I added two paralleled reversed 1N914 diodes between the audio line and ground which could be switched in an out. The diodes act as an audio limiter. The values I used were simply what was in the junk box. I do know that the HQ-180, for example, produces several volts of audio. If the volume is up pretty high, the diode leads will get warm. I often use a light weight headset like the Walkman which is comfortable for long listening periods. I also use an old pair of 8 ohm magnetics if I need more filtering. They may be uncomfortable, and have poor fidelity, but are superior for CW work because they have an inherent frequency response peak which is ideal for CW listening. These mods are mounted in a small metal box with standard quarter inch phone jacks. The output has two jacks, one stereo, the other mono. Usually I keep both the Walkman and the old mag cans plugged in, and change to whichever works best for what I am listening to. (Steve Kennedy)

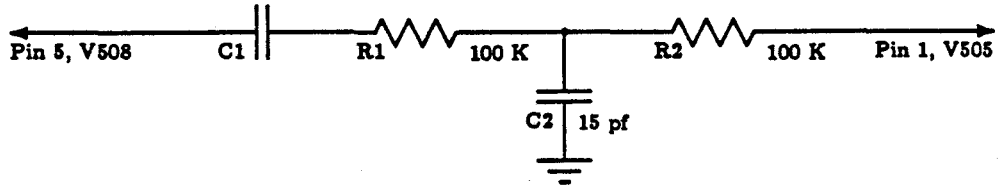


VARIABLE TUNING CAPACITOR NOTCHES: An interesting fact which few ever notice is that the main tuning and bandspread tuning variable capacitors often have several notches cut into the outer rotor plates which divide the edges into "tabs." If one is not careful, and these plates are slightly bent, alignment of the RF circuits may be degraded. Trash and dust may collect in the notches, so it is probably a good idea to clean them occasionally. If a plate is bent out of true parallel with the adjacent stator plate, dial cal-

ibration can change considerably, especially the bandspread calibration. The bandspread calibration is usually almost linear across the entire range, and it is possible that the capacitor was designed to provide very accurate calibration by bending the tabs on each plate at the factory. This is only a theory, not based on fact. (Steve Kennedy) [Somewhat against my better judgement I have included you comments, Steve, because this is a topic which has interested me for some time. Fiddling with these tabs can cause a major problem. Suppose you accidentally bend a plate enough or in such a way that you break the plate loose from the shaft. Then you are faced with the problem of removing the main or bandspread tuning capacitor and replacing it with a new variable capacitor. Removal is merely difficult and time consuming, but finding a replacement is probably impossible. Now I must confess that I have indeed fiddled with the tabs on my and other HQ–180's. I wanted to see if I could improve calibration on the BCB, and indeed you can if you are willing to spend *hours* bending the tabs on the oscillator section plates. Unfortunately, improving the linearity on some bands may and usually does degrade the calibration on other bands. If anyone knows more about this curious topic, please let me hear from you. Ed.]

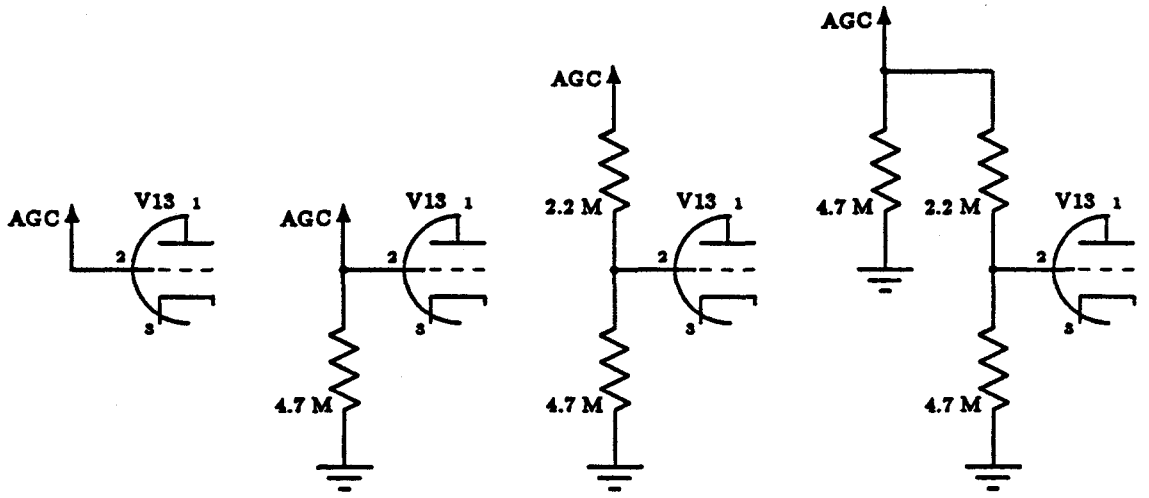
R–390A SYNCHRONOUS AM DETECTION: Champ. That's what I put it down to! *Champ* is an appetizing dish of boiled potatoes, mashed with chopped spring onions and a dab of butter. After a days toil there's little more satisfying than to settle in front of the radio with a plate of champ, a crust and a cuppa. Feeling particularly tired one night I left an unfinished plate atop my R–390A, switched off and retired early. Dreams were vague and barely recollectable, stark contrast to the incredible scene that greeted my eyes next morning. The champ was gone. Gone, just disappeared into thin air. And? Yes, two green wires were hanging from one of the receiver's large side plate holes. Top cover removal showed that these were cutoffs of 10 by 0.1 mm used in an internal fabrication with two 100 K resistors and a 15 pf capacitor. Only two wires had a direct electrical connection with the set; an end of the wire attached to one of the 100 K resistors was pushed down pin hole no. 1 of the BFO oscillator socket, V505, and one lead of the 15 pf capacitor was grounded beneath a screw which secures the BFO PTO mounting bracket. The resistors were connected in series, and the other capacitor lead was soldered to the junction of the two resistors. A wire from the other end of the series resistors was neatly wrapped 7 times around the AGC amplifier tube V508 and knotted in place. The set and BFO were turned on. "Wow, what a circuit!" I had in front of me a fully syncronous AM receiver, that locked onto weak carriers long before they could otherwise be detected, and rejected adjacent channel signals. It was less effected by splatter and impulse noise, did not suffer carrier related propagation or receiver passband filter distortions and had a useful noise limiter. The BFO was both AM resolver and SSB CIO; tune first then BFO resolve. Bit of Irish? Don't doubt me, the circuit works. It is non-intrusive and a real champ. The 7 turn wrapping of V508 creates C1. C1 taps the carrier, C2 shifts phase. (G. S. Maynard, 16 Woodford Ave., Newtonabbey, N. Ireland, BT36 6TL) [I must admit, Graham, that I doubted you. But I was so intrigued by your circuit that I rushed home and added one to an R–390A. By golly, it works, and works very well indeed! I didn't have a 15 pf capacitor on hand, so I used a 10 pf 500 VDC NPO. I also used half watt resistors, and no. 22 stranded insulated wire. Instead of grounding the 15 pf capacitor beneath the nut of the carrier meter zero adjust control as you indicated, I took a slight liberty with your design and grounded it at a screw on the chassis which secures the BFO PTO mounting bracket. At first I had a little difficulty replacing the BFO tube with the wire inserted in pin no. 1 of the BFO socket – I had twisted the strands making insertion of tube pin 1 difficult, and I initially ran the wire between the tube and the tube socket skirt, which caused binding. After a few moments thought, I untwisted the strands (about 5/16 inch insulation removal allows complete insertion of the strands into the pin hole), and ran the wire through a small cutout on the side of the tube socket skirt. The tube then inserted easily, and though the tube did not seat completely because of the

insulated wire between its bottom and the tube socket base, good contact was made with all tube pins. The stranded wire to pin 1 was 6 inches long (it could have been shorter), and the stranded wire to the 7 turn wrapping of V508 was 24 inches (including a couple of extra inches which can be removed after wrapping). The resistors and capacitor were soldered in a "T" configuration, with short leads. The resistor leads which attached to the stranded insulated wires were also cut short. But the ground lead of the capacitor was kept full length, with a hook bent into the end for sliding under the grounding screw. I tested the circuit first on strong local and semi-local MW stations about 3 pm local time. Adjusting the BFO to zero beat was delicate, but not excessively so, and long term stability was found to be very good, on the order of 5 – 10 minutes or longer. Both DSB (BFO frequency in the center of the mechanical filter passband) and SSB (BFO frequency at either edge of the mechanical filter passband) were tried. For SSB mode it seemed that best results were obtained when the signal carrier was no more than 20 db down on the mechanical filter skirt. Next, I tuned around the SW broadcast bands, listening mainly to weak signals with strong fading. In those cases the synchronous detector seemed to give the most improvement in DSB mode because DSB minimized audio variations due to fading. But I really don't have enough experience with the synchronous detector yet to draw any firm conclusions, and there are likely instances where USB or LSB would be better. All of my R–390A IF's have the Cornelius SSB modification, which may or may not cause performance differences between your receiver and mine. For example, I did not observe the noise limiting effect that you mentioned. However, your synchronous circuit is definitely a winner and certainly improves AM reception on strongly fading signals and on signals where SSB reception is desired because of interference on one sideband. I was so excited by the excellent results with this circuit that the next morning I dropped off a schematic at my colleague's office. Dr. Tom Williams, currently an electrical engineering professor here at Louisiana Tech University, has many years experience as a radio design engineer for some of the major USA electronic firms, including Collins Radio (now a division of Rockwell) and E Systems. Tom tells me that this circuit is called an injection locked oscillator, and that he played with the idea some years ago in a more sophisticated form using external transistor circuitry to implement a phase locked loop in a National NC–183D to which he had also added mechanical filters. Based on hints from Tom, and a peek at my copy of Radiotron Designer's Handbook, it seems to me that the circuit is essentially a low pass RC filter with parameters selected to pass a 455 kHz signal. That afternoon I tried a direct connection using tube test sockets and a 10 pf 500 VDC NPO for C1. It worked as well as the original. I also tried moving the RC filter input to the 4th IF, V504. It did not seem to work as well – BFO tuning seemed more critical. This means that to make the original circuit a permanent addition to an R–390A will require running a wire from the "AGC compartment" of the IF subchassis to the "IF amp compartment," a non-trivial task because you must either drill a hole in the metal plate that separates the compartments or pass the wire through the dificult-to-access existing hole that passes the existing wires. Miniature coax should probably be used. The next day I tried the injection locked oscillator circuit with an HC–10 converter to determine the feasibility of using it in an HQ–180A. It worked well, with one exception. The HC–10 drifted so badly that signals lost lock after a very short period, say 15 seconds. Oh, well... This indicates that the remarkable stability of the R–390A is a crucial factor in the success of the injection locked oscillator circuit. It also suggests that you should use this circuit with the crystal oven switch turned off. Ed.]



HELP WANTED: Could someone please sell me a 2.5 mH RF choke which I need to repair my HQ–180. I don't want to buy $10 or $20 worth of other parts that I don't need, and there are no electronic parts stores nearby. I also need the complete manual for the Hallicrafters SX–71 receiver. A Xerox copy would be satisfactory. (Edward McFadden, P. O. Box 248, Glenns Ferry, ID 83623)

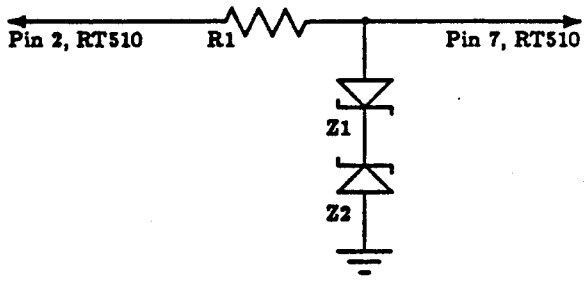
HQ–180 S-METER AMP VARIATIONS: Page 32 of my HQ–180 manuals (series 1 and series 3), which is an enlargement of the AVC and S-meter circuitry, has a number of incorrect labels: C145 (should be C75), C146 (C139), C147 (C140), R89 (R90), R90 (R89), R91 (R105), and R99 (R91). Also, in my HQ–180 the input to V13B (12AU7), the S-meter amp, is not as shown in the schematic as shown on page 32. After checking other receivers it was determined that there were at least three S-meter input circuits used in various production runs. After trying the variations I have concluded that these S-meter mods were made to "linearize" S-meter readings. With the early circuits, even moderately strong signals give near maximum meter readings. The latest circuit is more nearly linear, with approximately 6 db per S unit and nearly linear db over S-9 readings as compared to an R–390A. In early circuits, the meter zero adjust, R20, was 300 ohms, while in later circuits R20 was changed to 1500 ohms, and in early circuits R22 was 820 ohms, while in later circuits R22 was changed to 470 ohms. Another mystery which I accidentally solved recently is why the sensitivity control, R18 (1500 ohms), does not permit one to adjust the meter for full scale readings on strongest signals. The answer is that the meter amp cathode resistor, R88 (2700 ohms), is too high. Replacing R88 with a 2200 ohm resistor permits you to adjust the meter for full scale readings. The solution came about when a '180 was recently brought to me for repair. The meter indicated only S-9 on the strongest signals, and could not be adjusted higher. The problem was traced to a bad R88 which measured 9000 ohms. I didn't have a 2700 ohm resistor on hand, so I used a 2200. I haven't changed R88 in my own '180 yet, but I intend to. (Dallas Lankford)



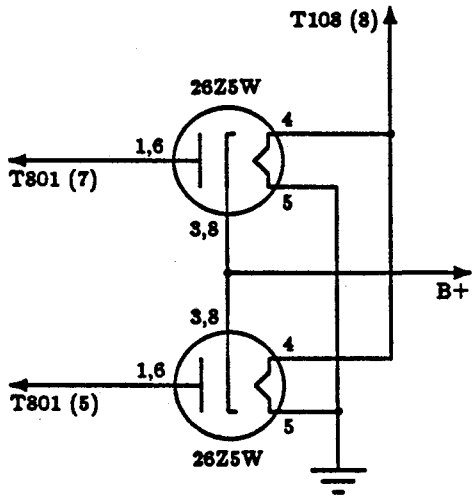
Manual, Page 32 Early HQ–180 Early HQ–180A Late HQ–180A

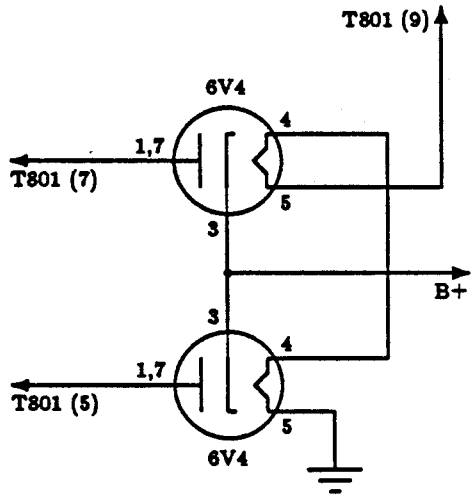
3TF7 SUBSTITUTE: There have been a number of suggestions in the past for replacing the expensive 3TF7/RT510 current regulator tube in the R–390A. Here is one which uses zener diodes. R1 is a 40 ohm 5 watt resistor, and Z1 and Z2 are 13 volt 5 watt zener diodes, 1N5350 or equivalent. The unused pin lugs on the RT510 socket can be used to mount the components. (Irving Megeff) [This is certainly one of the simplest substitutes for the 3TF7 that we have seen in *HSN*. If you have been living without a 3TF7 since your last

one died, using only a dropping resistor, you may want to give Irving's circuit a try. To make an almost plug-in version, use a 9 pin tube test socket with lugs around the top to mount the components. For a ground, solder a short length of stranded, insulated wire to an internal tooth ground lug and mount the lug to a nearby screw on the top of the IF subchassis, such as one of the screws which secures the BFO PTO mounting bracket. This is one that I intend to try. Ed.]



26Z5W SUBSTITUTE: The 6V4/EZ80 can be used as an inexpensive substitute for the scarce 26Z5W rectifiers in the R-390A when a simple wiring change is made to the rectifier sockets. I have a stock of about 60 of these tubes which I can supply for $5.00 a pair including shipping. Usually the power supply subchassis wiring connects pins 4 of the rectifier socket with a wire, and then from one pin 4 another wire runs to lug 8 of T801. Also, pins 5 are connected with a wire, and one pin 5 is connected to a nearby ground lug. To rewire the 26Z5W sockets for 6V4's, remove the wire which connects pin 4 and lug 8 of T801, remove the wire which connects the two pins 5, run a new wire from the ungrounded pin 5 to lug 9 of T801, and add two new wires connecting pins 1 and 7 on each tube. (Irving Megeff, 50-15 Weeks Lane, Flushing, NY 11365) [The increasing cost and scarcity of 26Z5W's makes this suggestion attractive. The 6V4 filament is rated at 6.3 VAC 0.6 A, which means it dissipates about half the power of a 26Z5W rated at 25.0 VAC and 0.3 A. The 6V4 also has a higher maximum plate voltage rating, 350 vs. 325 VAC, and a higher maximum DC current rating, 90 vs. 75 ma. Ed.]





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EDITOR'S CORNER

Are you there? I was badly mistaken that at least ten of you would write about your experiences with accessories. Not a single letter on that subject has arrived since the last issue. While I am on the subject of an almost empty mail box, special thanks to Graham Maynard for the quick reply to my questions and comments about his synchronous detector circuit for the R–390A and other matters. To those who waited patiently for me to print and mail copies of my HQ–180 Series Manual Supplement, please accept my apology for the delay. Some of the delay was caused by failures to include an SASE, and the impossibility of cashing foreign checks and money orders at my bank. If you still have not received your copy, send me a card or letter, and I will try again. In the future I will not attempt to deal with foreign checks or money orders. Even domestic checks became a hassle, requiring numerous deposits of $2 checks. Thanks to all of you who included two one dollar bills with your order. There is still plenty of material on hand for several more issues, but remember that this is your newsletter, and it continues to exist only if you send us material for publication. **Attention: In the future neither Chris nor I will respond to correspondence that does not contain an SASE.**

This document was produced with an IBM PC AT and a Cordata LP–300 laser printer using software developed by Personal TEX, Inc.

SHORT CONTRIBUTIONS

R-390A SYNCHRONOUS DETECTOR: I don't know if my set is different from others, but mine locks ±75 Hz and holds for hours. Maybe valve characteristics are a contributing factor, as I have made a number of substitutions – 6BZ6 for the 6DC6 RF amp and 6AH6 for the 6BA6 AGC IF amp. Recently I tried 100 K ohm resistors in the synchronous detector circuit for a friend's R-390A, but the phase lock was weak, only a few Hz. When I changed to 47 K ohm resistors, the lock was much better. This past weekend I added the synchronous detector circuit to yet another R-390A, this one with the 6BE6 BFO and product detector from *CQ*, January 1968. In this case 22 K ohm resistors worked best, and C2 was changed to a beehive trimmer to get the synch phase just right. (Graham Maynard) [Thanks for the additional information on your remarkable circuit. My version of your circuit seems to work about the same as yours. A lock of ±75 Hz is rather delicate when you consider that is only 15% of the distance between the 1 kHz marks on the BFO scale. But let me revise my estimate of stability upward. After my R-390A has warmed up for an hour or so, lock is maintained for hours on stable signals. I have demonstrated your circuit to several visitors, and all have been impressed. Here are a few more things I have observed about the circuit. I think I now understand the noise reduction you mentioned previously. On strongly fading signals one hears phase distortion which sounds somewhat like noise. With the synchronous detector in use, phase noise is greatly reduced. On most daytime MW signals it seems that lock is generally found on the counter-clockwise side of zero beat. But for SW and nighttime MW signals, lock is found on either side of zero beat. This may be because daytime MW signals are generally linearly polarized, while SW and and nighttime MW signals are elliptically polarized. Whatever the reason, lock seems easier to adjust on SW and nighttime MW signals. After my initial excitement with the circuit diminished, I had removed my plug-in version and resumed tinkering with a phasing circuit that I am developing to generate cardioid patterns by mixing a loop and LW. At first I was somewhat disappointed with the resulting nulls. At night weak DX in the nulls of stronger signal sounded somewhat like badly fading SW signals, apparently caused by strong sub-audible hetrodynes. Then it dawned on me that the synchronous detector circuit might help. It surely did! That evening I spent several enjoyable hours listening to R. Presnica in the null of WLS 890. Later I discovered that approximately the same inprovement can sometimes be achieved without the synchronous detector (BFO off) by adjusting the RF gain control so that the meter reads 0, changing to MGC, and readjusting the RF gain control for best sound. But often switching the synchronous detector in again (BFO on) is better. Anyone who uses phasing units to generate nulls with two antennas should definitely try your synchronous detector circuit. To pique our readers' interest, I'll mention that I am anxious to try your cardioid generating circuits, especially the broadband, untuned, large area loop and phasing circuit. Ed.]

R-390A TUBE SUBSTITUTIONS: For improved AGC range and a more linear RF gain control, I use a 6BZ6 in place of the 6DC6 RF amp, and a 6AH6 in place of the 6BA6 AGC IF amp. These two changes cause the carrier meter to read high. To bring the carrier meter readings down, I use a 12BH7A for the 5814A in V506. To improve local audio output quality, I use a 6AQ5 with pin 7 cut off for the 6AK6 in V603. (Graham Maynard) [I have changed to a 6BZ6 RF amp in one of my R-390A's because of difficulty in obtaining 6DC6's. The substitution does not change the carrier meter readings. Apparently it is the 6AH6 in place of the 6BA6 AGC IF amp which causes higher meter readings. The Cornelius SSB mod increases carrier meter readings, so the 12BH7A substitute for the 5814A in V506 might be a useful change in that case to bring carrier meter readings down. Unfortunately, I don't have any 12BH7A's on hand to give it a try. Incidentally, the Collins engineering report which describes the design of the R-390A mentions that the 6BZ6 may be used for the RF amp tube. The 6DC6 was chosen because it gives slightly better AGC control. My ears can't tell any difference. After writing the above I decided to give your 6AQ5 mod a try. A quick look in one of my old tube handbooks showed that the 6AQ5

and 6AK6 internal wiring are the same, *except* the cathode and pin 2 screen of the 6AQ5 are tied together internally at pin 2, pin 1 and pin 7 of the 6AQ5 are attached internally to the same screen, and pin 7 of the 6AK6 is attached only to the cathode. Early R-390A production runs did not connect pins 2 and 7 of the 6AK6 socket V603 together, but a later field and production change did. This change is what makes your mod possible. If anyone tries this mod, they should first remove the AF subchassis, check to see if pins 2 and 7 of the 6AK6 socket are wired together, and if not wire them together. I didn't notice much improvement in audio quality, but there is more audio power available – about 3 watts for the 6AQ5 vs. 1 watt for the original 6AK6. Also, the 6AQ5 has higher plate and screen maximum voltage ratings, 250 vs. 180 VDC, which should eliminate excessive local audio output tube failures that is observed in some R-390A's. Don't try this mod on the line audio output tube V604. The line audio output circuit is different. However, it seems to me that the same mod can be made to the line audio output by changing a few components so that the line output circuit is identical to the local audio output circuit. If anyone tries this, please let me hear from you. Ed.]

LONG WIRE ANTENNAS: For years I have used a 100 foot LW with about 20 feet of coax lead in. The design was taken from some long forgotten article, but I seem to recall that the purpose of the coax lead in was to minimize pick up of noise from house wiring. The design is bad for several reasons, as I discovered recently while developing phasing circuits. First, the coax lead in causes the antenna input circuit of R-390A's to function improperly so that the RXes *appear* to be insensitive on band 1, especially in the 500 – 700 kHz range. I have subsequently replaced my previous LW with a 65 foot LW and about 15 feet of unshielded lead in. Now MW signal levels are much more uniform, and low band insensitivity has vanished. In fact, MW signal levels are now considerably higher than necessary. SW signals levels are also higher. Second, coax lead in used with LW's causes most, if not all, antenna tuning circuits to function incorrectly. The reason is that a LW is equivalent to a resistor and capacitor in series, with a characteristic impedance of $R - jX$, where R is typically on the order of 20 ohms and X varies from a few 100 ohms to a few 1000 ohms at medium frequencies, depending on wire diameter, wire length, and frequency. Now if you insert about 15 feet of coax with a capacitance of 20 pf per foot, that is equivalent to attaching a 300 pf capacitor between the antenna and ground terminal of your receiver. This is generally not what the designer of the receiver had in mind when he designed the antenna input circuit. For a link coupled antenna coil, the result is that the input to your receiver becomes a tuned circuit. For the HQ-180A I estimate that the resulting resonant frequency is near the top end of the BCB. The R-390A antenna input circuit is more complex, and I have not analysed why it performs improperly with a LW and coax lead in. Apparently it, too, has a resulting resonant frequency near the top end of the BCB. The Q of the resulting tuned circuit is fairly low, but still high enough to cause insensitivity at the low end of the BCB. For those interested in pursuing this subject in more detail, there is a thorough discussion of inverted L antennas in the **Radiotron Designers Handbook**, ed. F. Langford-Smith, Fourth Edition, Published by the Wireless Press for Amalgamated Wireless Valve Company Pty. Ltd., 1953, Reproduced and Distributed by RCA Victor Division, Radio Corporation of America, Harrison, N.J., pages 902-904. The formulas there do not seem to be especially accurate based on measurements I have made, but they will give you numbers to play with. The impedance of my 65 foot LW with 15 feet of bare lead in, which is equivalent to an 80 foot inverted L antenna, measures about $R - j1000$ at 540 kHz and $R - j300$ at 1600 kHz. When used directly with the R-390A, the RX antenna trimmer tunes the antenna to resonance (don't ask me how). For use with link coupled antenna input circuits, such as the HQ-180A, or my phasing unit, a variable inductor with a range of about 30 to 300 μH is required. Such a wide range variable inductor is not an off-the-shelf item, so I have been playing with the tuning unit from an old tube type car radio to see if one can be home brewed. Perhaps a switched inductor in series with a variable capacitor would be a better solution. (Dallas Lankford)

R-390A 8 KHZ FILTER: Did you ever wonder why the R-390A sounds so good at 8 kHz? It is an 11 kHz filter, not 8!! The Collins spec sheet states that the 3db bandwidth is 8 kHz and the 6db bandwidth is 11 kHz. (Jonh Peterson) [John raises an interesting point. I looked over the spec sheets he sent me and observed that the 8 kHz 3db bandwidth is *nominal*, and the 11 kHz 6db bandwidth is *maximum*. The 8 kHz filter in the R-390A I happened to have on this afternoon measures 9 kHz at 6db down per the carrier level meter, and I have a 16 kHz filter removed from one of my units which measured 8 kHz at 6db down. Ed.]

SP-600 FILTER CHOKE LEAKAGE: Here is a tip on avoiding an SP-600 problem before it happens. Draw a picture and label the wires of both power supply filter chokes. Remove all wires from both filter chokes and measure the resistance to ground of each choke terminal. Many show 15 K ohms or less. They must have potted them with tar from our famous La Brea tar pits. The remedy is to insulate the chokes from ground by enlarging the base plate mounting holes, and then to remount the chokes using insulated step washers. If your set has the crystal box assembly above the chokes you will need to remove the bracket above the chokes. Before resoldering the wires, recheck the resistance to ground of each terminal. The leakage should be gone, B+ voltage should be normal, and the power transformer and chokes should run cool again. If you need the power transformer, I have some original new ones. (Dick Walser, Airborne Electronics Co., 5028 Cartwright Ave., N. Hollywood, CA 91601, ph. (818) 766-2747)

HELP WANTED: I am still trying to locate an operator's manual for the R-390A, TM11-5820-358-10. All the usual sources have failed. Any help from anyone out there? (Gerald Murphy, Box 152, Scottsville, NY 14546)

3TF7 ELIMINATION: This is a simple mod to the R-390A which forever eliminates any further concern with the fragile and expensive 3TF7 tube. The basic maneuver is to tap 12.6 VAC from the secondary of the power supply transformer, and supply it to the series connected heaters of the BFO and PTO tubes. I decided to do this after reading in the Collins Engineering Reports (see *HSN* **12**, page 2) that Collins engineers did not feel the 3TF7 was needed, but included it to satisfy the Signal Corps specs. The procedure is as follows. (1) Remove the power supply subchassis. Solder an insulated, stranded #22 wire from the power transformer secondary lug #9, which is a 12.6 VAC tap on the 25.2 VAC supply, run it to lug J-811-9, the unused lug, on the power supply output jack, slip an insulating sleeve over the wire, solder the connection, and slide the sleeve over the solder joint. (2) Open plug P-111 by removing the clamp and two Phillips head screws, and push back the metal shield to expose the contacts. Locate lug P-111-1, which should have two brown and white wires connected to it. In my R-390A the smaller diameter wire of the two runs to lug P-112-8, and is the line to pin 2 of the RT-510 socket. Cut this wire close to lug P-111-1, slide an insulating sleeve over it, solder it to P-111-9, and slide the insulating sleeve over the solder joint. I had to splice a short piece of wire to reach P-111-1, and covered the whole thing with a tough plastic sleeve. (3) Finally, connect pins 2 and 7 of the RT-510 socket. (Gerald Murphy)

AN/FRR RECEIVERS: I have quite a few receivers, such as the SP-600, R-390A, and so on, but my favorite receiver is the AN/FRR-23. I don't know how many of our fellow hollow staters know of this receiver. It must have been designed around 1950. The literature I have on it is dated 1954. Mine was made by RCA, and is one of a series of three. The AN/FRR-21 tunes 14 to 600 kHz in five bands, with a 60 kHz first IF and 200 kHz second IF (200 kHz IF only on some bands). The AN/FRR-22 tunes 250 kHz to 8 mHz in five bands, with 1600 and 200 kHz IFs. And the AN/FRR-23 tunes 2 to 32 mHz in five bands, with 1600 and 200 kHz IFs. I believe that other designations, such as FRR-18, -19, MRR-1, -2, -3, and SRR-11, -12, and -13 covered almost identical receivers. One of the advantages of the FRR receivers is that they are considerably smaller and lighter than the SP-600 and R-390A. The FRR does not break your back as you try to mount it

in a rack. The FRR tuning system is really nice – a projected dial on a small frosted glass screen. Tuning accuracy is very good when the dial is calibrated at the nearest 200 kHz crystal oscillator calibration point. Stability is excellent. I have never noticed any drift, and a station comes in days later just where it was before. My version of this set has 1 and 3 kHz mechanical filters, and an 8 kHz LC filter. The set has a very nice "slide out" feature, and while pulled out can be tilted so that the chassis is in any position, including upside down. The meters are similar to R–390A meters. The only drawback to the FRR receiver is that the tubes are subminiatures: (6) 5636, (1) 5644, (6) 5647, (6) 5718, (2) 5719, (2) 5840, (5) 5899, (1) 5902, and (2) 6X4, a total of 28 tubes. In some later models five of the six 5718 tubes were replaced by 1N458 diodes. I would be delighted to hear from anyone who uses the FRR receivers, and will try to answer any questions (include an SASE). If anyone knows a source for these miniature tubes, please let me know. (John Field, 117 Arroyo Place, Santa Cruz, CA 95060)

NATIONAL RECEIVERS: I collect old radios, and have several Nationals, including three SW–3's, an NC–100, an NC–101X, an NC–2–40–D, an HRO Senior, and HRO–W, an HRO–5TA1, and an HRO–60. I use the last receiver for what SWLing I do. I find it to be far superior to the earlier National receivers, but since I have no experience with Hammarlunds or Collins receivers, I can make no informed comparisons with them. I suspect that a design from the early 1950's, with some features going back to the 1930's, would not have the selectivity, stability, or versatility of designs from the 1960's. The HRO–60 was produced from about 1952 to 1965. It has two RF stages, three 455 kHz stages, including a crystal filter, is double conversion above 7 mHz, has a diode noise limiter, push-pull AF output, and (unlike earlier HRO's) a built-in power supply. It has voltage and current regulators, a temperature compensated oscillator, and provisions for a plug-in crystal calibrator, a NBFM detector, and an audio filter (or Select-o-ject, as National named it). The HRO–60 is huge and heavy, and it has no product detector, though several designs have appeared in *QST*. I have not tried any of them. When the original HRO was introduced in 1934, it had plug-in coils, a feature National continued to use for all HRO's until the HRO–500. Before 1950 the HRO's did not have a calibrated dial, and had separate power supplies. Early HRO's – HRO, HRO–5, HRO–5TA1, etc. – were black. The later ones – HRO–7, HRO–50, HRO–50TA1, and HRO–60 – were gray. The HRO–60 tunes from 50 kHz to 54 mHz with an appropriate coil set. I have almost all of the coil sets, but I do not have the plastic dial scales for them, and they are impossible to find nowadays. I mainly listen to the international SW broadcast bands, and find the HRO–60 perfectly suitable for that purpose. It is not satisfactory without modification for listening to the amateur bands. I would like to find a Hammarlund HC–10 to use with it because I believe the combination would form a powerful shortwave receiver. I would be happy to correspond with anyone having National receivers. (Walter Sutton) [Thanks for the information about National receivers. My only experience with National is the NC–400. I picked up a very clean, rack mounted unit in a Bud cabinet about a year ago. I suspect that it was seldom used because of an intermittent loss of sensitivity which I traced to an apparent partial short of the thick wire with black insulation which connects the stators of C24 and C25 to a lug on the bandswitch. It works fine now after I repositioned the wire. But in the process of realigning the NC–400 and checking everything out I discovered that the 4H4C ballast circuit had apparently been modified to use a 6-4 ballast tube. Is any one out there a balast tube expert? I can't even find specs for the 4H4C and 6-4. If anyone can help, I would greatly appreciate it. Anyway, I have not used the NC–400 since discovering the undocumented mod. The little I used it previously suggested that performance is similar to a Hammarlund HQ–150, i.e., very good. I haven't used the HRO–60, Walter, but it should be equal to or better than the NC–400 for SWLing, which puts it right up there with the HQ–150 and HQ–180(A). Of course, among hollow state receivers, the R–390A is in a class by itself with regard to dial accuracy, stability, and dynamic range. The NC-400 tunes 540 kHz to 31 mHz in seven bands, has 18 tubes,

two RF stages, three stages of 455 kHz IF amplification on the low bands, and double conversion with 1720 kHz IF above 7 mHz. It also has a product detector, and provisions for a crystal controlled 455 kHz BFO. That should provide excellent SSB reception, but I haven't checked it out. Reminiscent of the HQ–180(A)X, a front panel switch selects either variable oscillator tuning, or up to four crystal controlled channels. The plug-in crystal calibrator is dual frequency, 100 kHz and 1 mHz, a nice feature which simplifies high band alignment. The most interesting feature is provision for a plug-in mechanical filter module of up to three mechanical filters. My NC–400 does not have the mechanical filter module, but it should be possible to construct one from information in the manual. A review of the NC–400 is in *QST*, February 1960. Mine is a 1964 model. The NC–400 does have a couple of flakey points. The knobs are cheap plastic, hardly worthy of an 18 tube receiver which probably sold for around $500 in 1960. The antenna trimmer is mounted on a rickety bracket several inches behind the front panel. Repeated flexing had broken the wire connecting the trimmer to the main tuning capacitor, which I deduced while redoing the less-than-professional previous repair job. Also, the BFO variable tuning capacitor is mounted inside the BFO coil shield at the back of the chassis, attached by a long shaft to the front panel knob, and flexes even more than the antenna trimmer. The NC–400 is the most curious collection of quality, craftsmanship, and occasional shoddy design that I have ever seen. Ed.]

R–390A PTO ADVENTURES: Having read and re-read Dallas' article on the task in *HSN* 6, I was deeply into realigning the PTO on my 1962 R–390A. He cautions us to avoid moving the PTO shaft when removing the PTO. Well, in the excitement of it all, I must have moved it a lot. When I put it back in after removing the end point adjustment screw cap, I couldn't get a het for love or money at the +000 point like one is supposed to. Yegads. This was my first try at doing anything more technical than changing tubes, and being slightly over-awed by electronic gadgetry, I was miserable. I thought about it for a few days, and then realized I had probably moved the PTO shaft. If I ruined the alignment by moving the shaft, then I reasoned that I could fix it by moving the shaft in the opposite direction. But I didn't know which way I had turned it. Well, I couldn't mess it up any more, so I went back in and started over. I dialed up +000, locked the zero adjust, and after a few deep sighs, gripped one of the prongs on the Oldham coupler with needle nose pliers [use your fingers, Ed.], and turned the shaft. Sure enough, after some movement of the shaft, zero beat emerged. At that point I resumed the normal procedure for aligning the PTO, and everything went well. Thanks to Dallas for the instructions. They are a lot better than the Navships instructions which are downright misleading. (Fritz Mellberg) [You are certainly welcome, Fritz. Most of my information came from Dick Truax. So thank you Dick. Your contribution is excellent because it should encourage other beginners to learn more about their receivers. The mistake is very common, and I have made it several times myself. Here are some tips to overcome this mistake. With the R–390A on its side, the blue PTO plug and miniature coax connector attached, but the center disk of the Oldham coupler and tension spring removed so that the PTO shaft turns independent of the KCS knob, turn on the RX, and tune around the BCB with the KCS knob until strong signals or background noise are located. Then tune slowly up or down to +000, alternating between the KCS knob and the PTO shaft. You may want to wait until night when there are plenty of strong BCB signals. If you have not been too careless, you should find strong signals or background noise on band 1 between 900 and 1000 kHz, or in the 1000 to 1035 over-range. If you can't find the PTO frequency, write me. This procedure can also be used to locate the frequency of almost any PTO set to an unknown frequency. Depending on the PTO frequency, you may have to switch between bands 1 and 2 to make it to +000 on band 1. Be sure to find the PTO frequency by turning the KCS knob first. The reverse procedure can be disasterous. If you turn the PTO shaft too far in the wrong direction you can damage internal PTO parts. Then you will need to buy another PTO. Sorry, Chris. There is no room for the Publisher's Corner this time. Ed.]

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EDITOR'S CORNER

Hello again to all vacuum tube aficionadoes everywhere. Please note the price changes above, due mainly to postal rate increases. Also note that issues 5 and 6 are currently out of print. Chris is working on an anthology of the best parts of those issues. I changed our logo to all Roman fonts, and modified our information box above, but I don't have strong feelings one way or the other about that. If you want the old style back, let me know. I hope to put a lot into this issue – addresses and comments about where to buy connectors, tubes, parts, tools, manuals, test equipment, etc.; important information about ballast tubes, especially the 3TF7; R–390A meter radioactivity; my experiences rebuilding an SP–600; an improved R–390A synchronous detector from Graham Maynard, and more.

Normally we try to keep negative things out of *HSN*, but in this issue I am making an exception. I had such a bad experience recently with Surplus Sales of Nebraska and its president, Robert L. Grinnell, that I feel an obligation to warn our readers to avoid them. And in case you don't read the Editor's Corner, I am making that warning the lead contribution of this issue.

Price changes are effective July 1, 1988.

SHORT CONTRIBUTIONS

SURPLUS SALES OF NEBRASKA: Maybe my saying a *few* words about my bad experiences with SSNe and its president, Robert L. Grinnell, will save some of our readers time, money, and similar bad experiences. I strongly advise that you do not buy anything from SSNe by mail order. (Dallas Lankford)

RF CONNECTION: 213 North Frederick Avenue, Suite 11-F, Gaithersburg, MD 20877, (301) 840-5477. If you are looking for RF connectors, this is probably the place to find and buy them. You might be a little hesitant to place a VISA order with an answering machine, but the fellow who runs this outfit, whoever he is, is O.K. We recently purchased unused Star UG-636A/U connectors which adapt the R-390A unbalanced antenna input to BNC female for $5 each, plus a 4% VISA surcharge, plus UPS shipping. Even more recently we bought unused Kings UG-290A/U connectors (bulkhead bolt-and-nut mounting, solder lug to BNC female) for $1.50 plus the usual 4% VISA surcharge, plus shipping charges. We had an old price of $1 each which was too low, but the fine fellow called to ask if we wanted them at the higher price. Of course we did, because he called to inform us of the higher price, and because the price was reasonable. In both cases he must have shipped the orders the next day because they arrived within a week. RF Connection also carries UG-971A/U connectors which adapt the R-390A balanced antenna input to unbalanced C female for $5 each the last time we checked. Be sure to inquire about price changes, and send an SASE with any letter of inquiry. (Joe Bunyard and Dallas Lankford)

DAILY ELECTRONICS: P.O. Box 5029, Compton, CA 90224, (213) 774-1255. In my opinion, this is the best source for tubes, at least for receivers and test gear. I have purchased over 200 tubes from them during the last few years, and received only four bad 6DC6's and a bad 4H4C ballast. Their prices generally range from about $2.50 to $4 for most of the tubes in our favorite receivers such as the R-390A, HQ-180A, SP-600, etc., the exceptions being ballast tubes which they currently sell for $20, gasp!!!, 26Z5W's for $8.50, and some other uncommon tubes. To order from them either call for price quotes, or write a letter with a list of the tubes you want, leave a space beside each tube for them to write a price, and include an SASE. They do not accept credit cards to the best of my knowledge, but they do accept personal checks. They are vague about shipping charges. I add $3.50 for small orders, say 10 to 15 tubes, and as much as $5 for larger orders, say up to 50 tubes. Remember that I am in Louisiana, so shipping charges to the East coast may be somewhat higher. I have never been able to get an answer about their return policy for bad tubes. Presumably all sales are final. For this reason I advise restraint in buying high priced tubes from them. Some of their tubes are military surplus with date codes on the boxes, some are in the usual commercial boxes, and some are packaged in new plain white boxes with just the tube number printed on the end. All their tubes appear to be unused. You may be able to find some tubes cheaper by dilligent scrounging, attending hamfests, et al. But if you include the extra time and money you spend hunting for cheaper tubes, you can seldom beat the convenience and prices of Daily Electronics. (Dallas Lankford)

ANTIQUE ELECTRONIC SUPPLY: 688 West First Street, P.O. Box 1810, Tempe, AZ 85281, (602) 894-9503. If you don't already have their 1988 catalog, slip $2 in a envelope and order one. They currently sell 26Z5W's for $4.50 each, and sell a number of other useful and desirable items, such as a tube extractor for $2.73, a dual 7 and 9 pin miniature tube pin straightener for $4.07, alignment tools, all kinds of hard-to-find books (G.E. Tube Handbook for $3.50, Sam's Tube Substitution Handbook for $5.95, and others), and high voltage tubular and electrolytic capacitors. (Joe Bunyard and Dallas Lankford)

FAIR RADIO SALES: 1016 East Eureka Street, P.O. Box 1105, Lima, OH 45802-1105, (419) 227-6573. No discussion of where to buy tube gear and parts would be complete without mentioning Fair Radio. Their catalog seems to be free, so naturally you will want one. They sell all sorts of military surplus gear and parts, including the R-390A

checked, complete with meters, for $345 plus shipping, or "as is" without meters for $175, and in several other conditions at other prices. They also sell some R–390A subchassis (did you know that the plural of chassis is chassis?) depending on availability. If you want or need test gear, they have signal generators, VTVM's, scopes, and used to sell a tube tester, although I don't see one listed in their latest catalog, WS-88. And they have *partial* (italics added by me) reproductions of manuals for many of the popular receivers and other equipment. You should discuss the contents of their partial reproductions of manuals before you buy one because you may not get all the information you need. I bought a tube tester some time ago, and was surprised that the manual omitted the parts list which was essential to maintaining the tube tester because the schematic did not have all parts values listed. After some negotiations Fair Radio did provide me with a parts list. So in some cases they do have complete manuals. Their tube inventory is not as complete as Daily Electronics, and their tube prices are generally slightly higher. But when I include the four bad 6DC6's and bad 4H4C in Daily Electronics tube prices, there is hardly any difference between the two. I have done several hundred dollars worth of business with Fair Radio over the last ten years, have had very few problems, and no problems that they did not make right without any fuss. (Dallas Lankford)

HI MANUALS: P.O. Box 802, Council Bluffs, IA 51502. Their catalog, which you must purchase before you can order manuals from them, was $1 postpaid in 1986 ($2 surface outside the USA, and $3 air mail outside the USA). It is 11 pages of two column listings in *small* print, about 180 manuals per page, maybe 2000 manuals total. Military surplus listings are incomplete, for example, no R–390 or R–390A manuals. Collins, Drake, Hallicrafters, Hammarlund, Heath, National, and many other listings are more complete, but some manuals are still missing, for example, the 51J4 and SPR4. Several hundred companies are represented in their catalog, some with only one manual. Their manuals are usually reproductions, but they are nice reproductions. Here is a quote from their "Order Terms" of catalog F. "WHAT YOU GET. Our collection is not inexhaustable, so few will now be originals, and you should expect to get a copy. We make copies about as good as the originals, but remember in the good old days many of the manuals were really bad by today's standards. They were, frequently, a few poorly done sheets in mimeo or spirit duplicator. If you order one of these you will get a good copy of a poor manual. Before WW-II many just told how to turn it on and gave a schematic. Many of our books are just what you would have received if you had bought the set new. Many companies made production changes without a similar change in the manual they supplied, so we can't guarantee what you have and our manual will match 100%. We do not include any large, fold-out pictorials that may have been with manuals (you can get a quote on what, if any, could be supplied and price by submitting a $5 research fee). Unless individually excepted in the INFO column with a listing (X), you will get a schematic, but those larger than 1 page in size will be in page sections, unassembled." My only direct experience with them was when I ordered a copy of the 34 page NC–400 manual for $11.50 about a year ago. I was completely satisfied with what I got. If you need a manual quickly and conveniently, Hi Manuals is likely the place to find it. (Dallas Lankford)

HAM TRADER YELLOW SHEETS: P.O. Box 2057, Glen Ellyn, IL 60138. This is without a doubt the best way for individuals to buy and sell electronic gear short of attending hamfests in person. The name might suggest that it is only for hams, but there are plenty of our favorite reseivers bought and sold, and anyone can subscribe and place ads. To get acquainted with the Yellow Sheets you may take a mini-subscription, $3 for 5 issues (bi-monthly). A one year subscription is 24 issues for $12. Overseas subscriptions are $1 per issue and are sent via air mail. Individuals are entitled to submit an ad with their subscription, or at any time thereafter, until their subscription expires, at a rate of 28 cents per word, where equipment designations like R–390A count as one word. Almost everyone who is active in buying and selling receivers, accessories, and test gear has used the Yellow Sheets and likes them. (Joe Bunyard and Dallas Lankford)

RADIOKIT: P.O. Box 973, Pelham, NH 03076, (603) 635-2235. If you build loops, amps, phasing units, antenna tuners, converters, or whatever, it is likely you have ordered things from Radiokit. They don't sell tubes, and what gear and active devices they do sell are solid state. But if you want hard-to-find items like Jackson Brothers 6:1 or dual 6:1/30:1 vernier reduction drives, Jackson Brothers, Cardwell, and Millen variable capacitors, miniature coax, Scotch 27 Glass Cloth Electrical Tape, Coax-Seal, Hammond chassis and diecast aluminum boxes, LMB cabinets, Amidon toroids and ferrite beads, J. W. Miller coils and chokes, B&W inductors, and on and on, then you will want to send them $1 for their latest catalog and price list. (Joe Bunyard and Dallas Lankford)

R-390A RADIOACTIVE METERS: Several people have written us lately expressing concern about the radium dials on R-390A meters. It is, of course, understandable that there would be some concern. Three Mile Island and Chernobyl have entered the world's collective consciousness. Rather than make too light of a possibly serious problem, Dallas began to collect some facts. First, an R-390A user in Ruston, Rick Burns, just happened to have a version of TM 11-5820-358-20 with "Changes 2 Through 4" which lists several radiation sources in the R-390A and gives activity numbers. There are apparently at least two meter models with different Ra226 activities, one rated at 0.69 μCi, the other 0.40 μCi. To determine what that meant, and to measure radiation dose rates of typical meters, Dallas took line and audio meters to the Nuclear Center at Louisiana Tech University where the director and Dallas measured the dose rate with a sensitive, calibrated, radiation meter. Both meters measured less than 0.5 mR/hr at about 1 cm, i.e., with the radiation meter "window" pressed flat against the front surface of the R-390A meters. According to *The Code Of Federal Regulations*, 1987, section 414, the "Permissible Levels Of Radiation From External Sources In Unrestricted Areas" is 0.5 R/year, 100 mR/week, and 2 mR/hour for adults (over 18 years old), and 1/10 of these values for minors (under 18 years old). An R-390A with two meters typically will not exceed the permissible hourly radiation level. But the radium paint on these meters was applied by hand, so some meters might exceed the permissible hourly radiation level. If you kept two meters with their faces pressed flat against your body 24 hours a day for one week you would typically receive 168 mR and have exceeded the permissible weekly radiation level. Similarly, you could exceed the permissible yearly radiation level. However, under normal operating conditions you will receive a much smaller radiation dose from your R-390A than permitted by 1987 law. Radiation is inversely proportional to the square of distance, so at 10 cm (about 4 inches) from the front surface of a meter the dose rate is about 5 μR/hour, or about 100 times less than at the front surface. If you used your R-390A 8 hours per day for one year with each meter an average of 4 inches from your body, then you would typically receive about 1/25 of the radiation permitted by 1987 law. We can't tell you that the meters are safe because some authorities say that no amount of radiation is safe. And you should definitely not open the sealed meters and handle or ingest the Ra226. If you want to dispose of your R-390A meters without breaking federal laws, you will need to study *The Code Of Federal Regulations* for the current year. It is available at many university libraries. We do not intend to remove our meters from our R-390A's or dispose of them. (Chris Hansen and Dallas Lankford)

R-390A RADIOACTIVE TUBES: Just as soon as we breathe a sigh of relief, the radioactive bugaboo appears again, this time in the OA2WA. There are at least three different manufacturers of radioactive OA2WA's and each used a different isotope. EEVC used uranium 238 with a rated activity of 0.1 μCi, CBS-Hytron used nickel 63 with a rated activity of 0.5 μCi, and Ratheon used cobalt 60 with a rated activity of 0.2 μCi. I had a CBS-Hytron OA2WA on hand which I carried to be measured, but I could have left the tube at home if I had remembered my long forgotten undergraduate university physics. Ni63 is a β emitter, and β's can't make it through the glass envelope. The radiation meter detected no radiation from my OA2WA. A curious point which emerged from our discussions is that the half lives of these three isotopes are radically different – 4.5 billion,

100, and 5.27 years respectively for U238, Ni63, and Co60. If the radiation is important for operation of the OA2WA, then Ratheon OA2WA's made in the 1950's and 60's are probably duds by now. And if the radioactivity is not important, why were radioactive isotopes used in the first place? We could not measure typical dose rates of the other two types of OA2WA's because I have none on hand. Glass tubes are not nearly as sturdy as R–390A meters, so the wise individual will probably gently remove any OA2WA's from his R–390A's and use non-A OA2W's or OA2's. (Rick Burns and Dallas Lankford)

3TF7 SUBSTITUTES ?: In *HSN* **16**, page 4, it was said that the 3HTF4 is a substitute for the 3TF7. The 1987 Fair Radio catalog, WS-87, page 6, lists the 3TF4 and 3TFV4 as substitutes for the 3TF7. However, only a few weeks ago the chief engineer at Amperite stated that the 3TF11 is the only ballast tube which can be substituted for the 3TF7. Let us explain why. A ballast tube has two ratings, a voltage range where current regulation takes place, and the corresponding regulated current range. For the 3TF7 the ranges are 8.6 – 16.6 volts and 290 – 330 milliamps. For the other ballast tubes mentioned above the ratings are 3TF11, 8.0 – 17.0 V, 280 – 320 ma; 3HTF4, 4.3 – 8.3 V, 340 – 370 ma; 3TF4, 4.3 – 8.3 V, 280 – 320 ma; and 3TFV4, 4.0 – 8.5 V, 280 – 320 ma. In a typical R–390A the total voltage drop across the 3TF7 and the two filaments it regulates is about 27.4 VAC, the voltage across the 3TF7 alone is about 14.2 VAC, and the voltage drop across both filaments is about 13.2 VAC, or about 6.6 VAC each. Note that the 3TF7 is operating within its specified voltage operating range, and the filaments are operated only slightly above their recommended operating voltages of 6.3 VAC. The latter is not serious because my old GE tube handbook states "... moderate voltage fluctuations upward will not reduce the life of the filament to an unsatisfactory degree." Now suppose you used a 3HTF4, 3TF4, or 3TFV4. It will operate substantially beyond its maximum voltage rating, or the two filaments it regulates will operate substantially beyond their recommended operating voltages, or (and this is the most likely outcome) all will be operated substantially beyond their maximum (or recommended) voltage ratings. It is almost certain that maximum current ratings will also be exceeded. So if you make or have made any of the above substitutions, except for the 3TF11, you may experience degraded stability, and excessive ballast, BFO, and PTO tube failures. When something (e.g., cheap 3TF7 replacements) sounds too good to be true, it probably is not true. If you were one of the unlucky persons who rushed out and bought some 3HTF4's because of the *HSN* **16** contribution, please remember that *HSN* cannot verify every contribution before it is published, and that the editor and publisher assume no responsibility for the reliability or correctness of any contribution. (Joe Bunyard and Dallas Lankford)

BALLAST TUBE HANDBOOK: Anthony P. Jacobi, 8053 Maywood Street, Ralston, NE 68127. Tony is a world expert on ballast tubes, maybe *the* world expert. He solved my NC–400 ballast tube (4H4C) problem in every way, including measuring voltage and current ratings for the 4H4C, analyzing the undocumented NC–400 ballast tube circuit modification, selling me two good 4H4C ballast tubes, and recommending using a variac to power up the NC–400 in case I had not found all of the undocumented NC–400 modifications. If you have or think you will ever have ballast tube problems, you should add Tony's Ballast Tube Handbook to your library. It costs only $8 postpaid for 72 pages of data on more than 3600 tubes, American and European. Tony also sells a 56 page Ballast Tube Substitution Guide which lists over 2600 tubes for only $7 postpaid. (Dallas Lankford)

NC–400 BALLAST TUBE PROBLEM: As I said above, Tony Jacobi solved my NC–400 ballast tube problem completely. I would also like to thank Joe Berry for calling me to tell me the Amperite listed specifications for the 4H4C. In case any of our readers have or will ever have an NC–400, I'll briefly describe the problem and the solution. All the NC–400 tube sockets have the correct tube number stamped into the chassis beside the tube socket, and the ballast tube socket identification was 4H4C. Perhaps a previous NC–400 owner had replaced a dead 4H4C with a 6–4 ballast tube.

In any case, the 6–4 and the 6BZ7 filament were both operating rather far beyond their maximum voltages and currents. And as if to confirm this, the 6BZ7 tested bad on my tube tester, although the NC–400 seemed to operate correctly. Figure 1 shows the NC–400 schematic in the manual I received from Hi Manuals. Figure 2 shows the NC–400 that I purchased. In my opinion, the 100 ohm resistor is a production change which National added to later model NC–400's. The resistor did not appear to have been added by a previous owner (I can usually tell by looking). And an analysis of the circuit indicated that the 6BZ7 filament would substantially exceed its maximum ratings without the 100 ohm resistor due to the current rating of the 4H4C. In addition, Tony Jacobi and I concluded that the 100 ohm resistor should probably be a smaller value, say in the 30 to 50 ohm range. But I decided to leave the circuit as-is for the present because voltage measurements determined that the 6BZ7 filament was not outrageously high at about 6.8 VAC with the 4H4C in the circuit of Figure 2. Apparently the National engineers did not get the ballast tube circuit right on either the first or the second try. If you have an early production NC–400 you should probably consider installing a 50 ohm 4 watt (or higher wattage) resistor for the 100 ohm resistor in Figure 2. I would never have gotten so deeply involved in this ballast tube analysis if Daily Electronics had not sold me a bad 4H4C ballast tube which went "flash, poof" when I replaced the 6–4 and powered up the NC–400. A $20 tube failure gets your attention. Only after this did I discover my NC–400 had an undocumented ballast tube circuit modification. The chief engineer at Amperite suggested that the 4H4C ballast which failed had probably developed a leak in the tube pin seals and that the hydrogen gas which normally fills ballast tubes had mostly leaked out. That would cause an immediate failure like I observed. (Dallas Lankford)

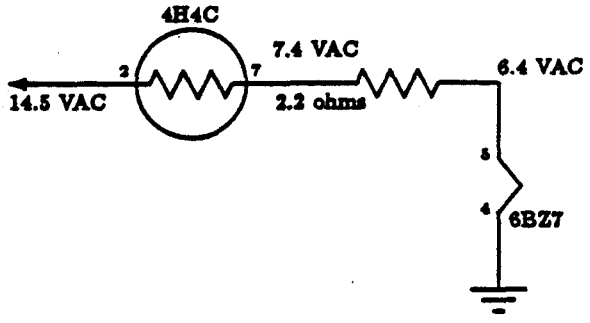


Figure 1

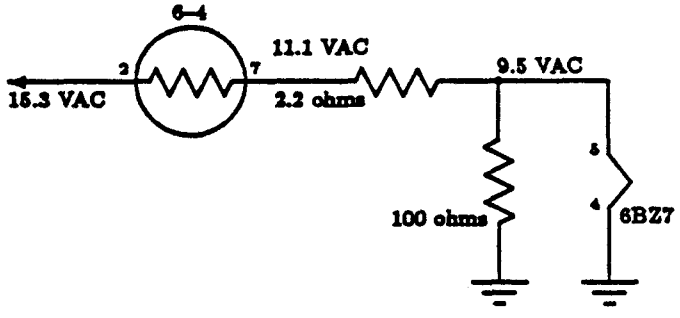
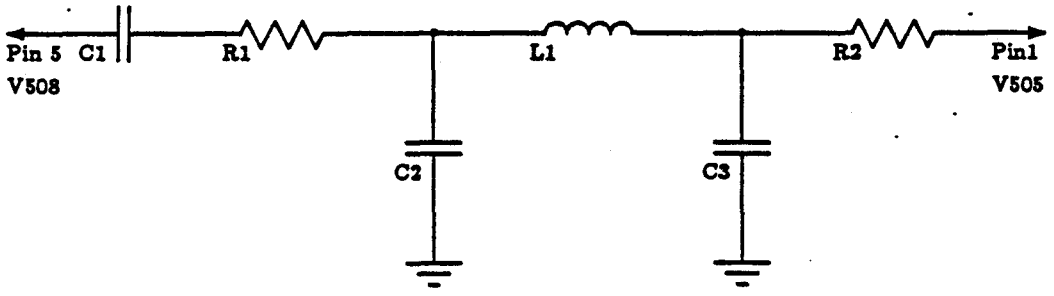


Figure 2

IMPROVED R–390A SYNCHRONOUS DETECTOR: Here is a new synchronous detector circuit which give better sync and range. C2 and C3 are 65 pf variable trimmers, L1 is is a 4.7 milliHenry subminiature choke, and the other components are as before. (Graham Maynard) [Thanks for keeping us informed of these new developments. See *HSN* 17 for the original circuit and discussion, and the additional comments in *HSN* 18. Ed.]



R-390A SYNCHRONOUS DETECTOR COMMENTS: I tried the synchronous detector circuit from *HSN* 17 and it worked O.K. But as mentioned in the original article, lock was sometimes maintained for only short periods. And some bands were better than others. For example, I was able to listen to Radio Australia all day with no drifting. [Maybe this is due to some of the crystals in your R-390A being more stable than others. Several years ago I observed that the stability of one of my R-390A's was not as good on the low bands. I traced the problem to a drifty 17 mHz first conversion oscillator crystal in the plug-in oven on the RF deck. Ed.] Eventually I disconnected it as it made RTTY and ICW reception a pain in the proverbial. (Terry Robinson)

Now that Graham has given us two synchronous detector circuits, lets call them GS1 and GS2. When a ham friend was unable to obtain *any* lock with GS1, a little detective work revealed the following. GS1 does not work at all in some R-390A's, and the cause appears to be different internal parts in different BFO PTO brands. Motorola BFO PTO's work best with GS1, Electronics Assistance Corporation BFO PTO's are a close second, Stewart Warner BFO PTO's are O.K., but Collins BFO PTO's don't work at all with GS1. I confirmed that the BFO PTO's are the crucial difference by switching a Motorola BFO PTO with each of the other BFO PTO's, but otherwise not changing the other IF subchassis. In each case the modified subchassis performed identical to an all-Motorola IF using GS1. To satisfy my curiousity, I removed the shield from each PTO and proved what I suspected – internal parts were different in each PTO. I suspect the culprit is L508, a 60 μH, tapped, miniature, encapsulated inductor. But I didn't try trading internal parts to verify my suspicion. Incidentally, the R-390A schematic for the BFO PTO is incorrect because it shows the BFO pitch varying L508. Actually, the BFO pitch is varied by moving a ferrite core in and out of L509, a 12 μH coil about 0.5 inch diameter with about 25 turns of #31 enameled wire. Maybe GS2 will work with Collins BFO PTO's. (Dallas Lankford)

SP-600 OVERHAUL: Even with Bob Kulow's warning from *HSN* 16 and 17 echoing in my mind, I just couldn't pass up a $50 SP-600-JX-14 at the Jackson, MS hamfest. I accidentally ran Bob's bad BT (black tubular) comments twice in successive *HSN*'s. I don't know why. If it was a subconscious warning to myself, it didn't work. The SP-600 was supposed to "work great." Of course, when I got it home, fired it up, and received only super-locals, I was not surprised. Injecting a 455 kHz source into the IF at various places led me to a shorted BT screen bypass in the 2nd IF amp. The wide open crack in that BT was hidden from view between the BT body and chassis. A careful inspection in bright light revealed other cracked BT's all over the place, so I decided to follow Bob's advice and replace them all.

By my count there are a total of 39 – .01's and 14 – .02's, though my manual copy lists only 37 – .01's. There are also three other tubulars in my RX which I may replace: one .05, 600 V, one .25, 200 V, and one .25, 600 V. If you use .01, 1 KV disc ceramics, as Bob did, and which I have done, you will have to spend some time planning different positions for the disc ceramics. Or if you use 600 V Sprague OD (orange drop) tubulars, some positions will also need to be changed because the OD's are not axial lead style like the BT's. Bob recommends against using tubulars for BT replacement because they have some inductance, but due to increasing difficulty of obtaining .01, 1 KV disc ceramics, you may not have a choice. Even if you stumble across a free box of unused BT's, do not use them. My associates in the Louisiana Tech University electrical engineering department tell me that they have discarded all BT's from their inventory because they are so unreliable. According them, disc ceramics, which were not manufactured in quantity until the late 1940's or early 1950's, are quite reliable, and should be O.K. either new or surplus. Some tubulars also have very good shelf lives, such as Sprague "Vitamin Q," which were produced for other companies, such as Western Electric, with no Vitamin Q ID. These high class axial lead tubulars have metal cases with a glass seal in each end. The small value Vitamin Q tubulars often had transparent insulation around the tube, and so they could be used as replacements if you can find them and afford them.

I could probably devote an entire issue of *HSN* to my SP–600 rebuilding experiences, but that does not seem appropriate. If you want to chat about my experiences, give me a call at (318) 255-6550 evenings 7–10 p.m. CDT, or weekends almost any time before 10 p.m. CDT. Here are a few tips which may give you some clues about the complexity of the task. I did not plan to do the overhaul in a single weekend as Bob did, but I did not expect it to take the 100 plus hours of labor I'll have invested in the overhaul project when it is finished. I have already used over 25 feet of Chem-Wik "Lite" .100 inch desoldering braid (the only kind which works really well), and I still have half the RF deck to rebuild. To replace the BT's in the IF strip you will need to remove the bandwidth switch assembly. You should make sketches of everything you remove so that you do not have to rely on memory or the schematic. I made 12 pages of sketches for the IF strip alone. If anyone has previously replaced BT's in your SP–600, it may take three times as long to fix his work, and some of the replaced tubulars may not be black. Some people don't bother removing solder and old leads, but just cut the old leads flush at the lugs, lay new leads on top of the lugs, and dribble more solder onto the lugs. Ugggh!!! You should test all replacement capacitors, whether new or surplus, for opens and shorts before you put them into your SP–600. Two of the surplus .01's I planned to use were open. If any of the BT's shorted and drew a lot of current before they "burned open," you may have some damaged, insulated, stranded wire which may require unlacing some of the wiring harness, replacing the wire, and relacing the wiring harness. The marvelous turret contains 24 ceramic coil-and-trimmer assemblies which are held in place by tension-loaded, metal clips. Fortunately you only have to remove 6 of these to replace BT's. I removed the filter choke assembly to repair some sloppy field change work, and to test the filter chokes (per Dick Walser's tip in *HSN* 18) and electrolytic for leaks. Removing the RF deck and replacing the BT's in the front end is the most difficult work I have ever done. If someone has been in there before you, it may take you five times as long to fix his repairs. There are something like 18 wires and 4 ground straps which must be unsoldered to remove the RF deck. The 4 flimsy ground straps have lugs on one end which are bolted to the main tuning capacitor frame with small, difficult-to-access, slotted, hex head, machine screws. If one of the ground straps is loose, you should tighten it. Otherwise you may have a noise source in the front end of your RX. But if you break one while tightening the hex head bolt, replacement is only possible by removing insulators containing stator plates from the main tuning capacitor. You won't have anything on hand like these flimsy ground straps, so you'll have to use something like an internal tooth ground lug. And then you'll have to realign the stator plates after you replace them, which is not easy.

I doubt that there is a single SP–600 in existence today which does not need all tubulars replaced, unless the owner has already replaced them and done the job right. An SP–600 full of leaky, shorted, and "burned open" BT's is probably a fire hazard. I would not leave one turned on and unattended even for a few minutes. (Dallas Lankford)

PUBLISHER'S CORNER

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The new prices take effect on July 1, 1988.

THE HOLLOW STATE NEWSLETTER

FALL 1988 No. 20

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EDITOR'S CORNER

It is curious how much misinformation and how many myths there are about hollow state gear. For example, in the *WRTH* 86 best and worst equipment article we find that among the best of the boat anchors are the "— R–390 series of military-surplus receivers and their civilian counterparts. Those manufactured by Collins are usually the pick of the liter. Parts are scarce, but available." Well, one thing was almost right. The R–390A (and only the A model) was then and remains now the best of the boat anchors by almost any reasonable criteria you care to use. However, there are significant differences among the R–390 series receivers, and I doubt that many knowledgable hollow staters would trade an R–390A for, say, an R–392. Do you know of any civilian counterparts for any of the R–390 series receivers? I don't. The R–390 (non-A model) does not have mechanical filters, and spare parts are scarce. The R–391 also does not generally have mechanical filters (although at least one R–391 did according to a picture of the R–391(XC-2)/URR in the

Collins engineering report "Cost reduction program for radio receivers R-390 / R-391( ) / URR"), few were produced, the autotune feature frequently caused excessive gear wear, and spare parts are scarce. The R-392 does not have mechanical filters, requires a 24 VDC power source and special power plug, and parts are scarce. Also, the Collins R-390A's are usually not the pick of the liter, because only a few R-390A's were manufactured by Collins, mainly in 1956, which means they are among the oldest and often the most used R-390A's. From personal experience, some of the best R-390A's in terms of physical appearance and quality of components and construction, especially the critical BFO PTO and VFO PTO, were manufactured by Motorola and Electronic Assistance Corporation (Hammarlund's military division). And dare I utter the heresy that Motorola PTO's are even better than Collins PTO's? R-390A parts have been and remain plentiful, for example, from Fair Radio, Baytronics, through the Ham Trader Yellow Sheets, or at local ham fests. It is often more cost effective and convenient to buy an entire R-390A as your source of spare parts. A second R-390A can also help you isolate tube problems and component failures by trading subchassis.

SHORT CONTRIBUTIONS

NOSTALGIA: *Communications Receivers, The Vacuum Tube Era: 50 Glorious Years, 1932 - 1981*, by Raymond S. Moore, available from RSM Communications, P.O. Box 218, Norwood, MA 02062, for $14.95 plus $2 shipping and handling, MA residents add $0.75 sales tax, is definitely a book for collectors, connoisseurs, and admirers of communications receivers with 112 glossy pages which cover over 700 receivers and 51 companies. [Ed.]

WANTED: I collect manuals for old valve receivers, particularly the R-300 series, and would like to purchase manuals or reproductions for these receivers, except the R-388 and R390A which I already have. I would also like to buy a Hammarlund HC-10 converter. (Terry Robinson, 21 Russell Ave., Woodend, Vic., 3422, Australia)

HELMUT SINGER ELECTRONIK: Feldchen 16-24, 5100 Aachen, West Germany. On your next trip to Europe, Deutschlands größtes Surplus-Versand-Angebot (Germany's greatest surplus mail-order house) might be a must-see . Among other things, they have 26Z5W's for only DM36, which is about $30 Australian. (Terry Robinson) [DM36 is $21.40 at current exchange rates. And we complain about $20 ballast tube prices! I wonder what they charge for a 3TF7 in West Germany? Ed.]

SP-600 REBUILT: This is a continuation of my SP-600 comments begun in *HSN* 19. Without Bob Kulow's help, I might not have reassembled the SP-600 correctly. My SP-600-JX-14 was an R-274C/FRR, which is actually a family of receivers depending on the serial number. After Bob kindly sent me the correct schematic, reassembly went smoothly. Well, almost. One of the RF deck contacts broke while cleaning it. Fortunately, there are one or two unused contacts on the ceramic bases of the RF deck which can be removed from the ceramic base provided any and all solder is removed and you pry it out carefully. Was it worth the effort? I suppose that is a matter of opinion. A friend of mine who has observed my radio hobby for years with mild amusement lost his head over the SP-600 and wanted it so badly that I let him have it. One reason he likes it is because it reminds him of a console AM/SW receiver his parents had when he was a child. The single, slow, flywheel tuning is easy to use and convenient for scanning the SW bands. The absence of an antenna trimmer also simplifies tuning, and does not seem to degrade sensitivity, which is about as good as any other top-of-the-line receiver. I don't like the selectivity options of 13, 8, 3, 1.3, .5 amd .2 kHz because of the non-optimal voice bandwidths. But the 8 kHz LC bandwidth is O.K. for strong signals, and the 3 kHz crystal filter bandwidth is acceptable for weaker signals in the crowded SW bands. There is no built-in calibrator, which seems like an oversight. With an outboard 100 kHz crystal calibrator, accurate frequency determination should be possible using the bandspread dial which is geared directly to the main tuning dial. The crystal phasing control seems virtually useless to me, not nearly as good for

notching hets as some crystal filters I have used. I have been unable to locate a cabinet (new or used) for the SP–600 because of its greater than normal depth. Its 66 pound weight makes it difficult to work on, especially for someone with back trouble. But if you collect classic tube receivers, the SP–600 is a must-have item because there is nothing else like it. The turret bandswitch assembly and RF subchassis are truly remarkable. I also like the R–274C/FRR appearance, especially the large tuning and bandswitch knobs and smaller knobs with engraved metal skirts. A Hammarlund data sheet shows an SP–600 with different (smaller) knobs that are not as attractive, and perhaps not as functional. The data sheet also shows the SP–600 mounted in a matching cabinet with dimensions 21.5" wide, 12.75" high, 17.25" deep, and 87.5 pounds total weight. (Dallas Lankford)

HAMMARLUND HQ–120: The HQ–120X is the granddaddy of many post WWII Hammarlund receivers. It was introduced circa 1939–40, retailing for $280 plus $6.50 for the matching SC–10 speaker. [The December 1938 *QST* contains an advertisement announcing the HQ–120. In the April 1939 *QST* the "X" suffix was mentioned for the first time. Apparently the 120 and 120X are the same receiver. In the January 1939 *QST* the HQ–120 list price was given as $215.00, including tubes, crystal, and speaker. By the end of 1939 the discount price was as low as $129. Ed.] The HQ–120X is perhaps best described as a pre-war HQ–129X with several significant differences. The 120X used grid cap tubes, including 6S7, 6K8, 6F6, 6V6-G, VR150, 6F8G, 6J7, and 6SF5. I have obtained spares for all at $2. The 6SF5 and 6F8G are scarce. The front panel is painted flat black. A gray front panel was optional, but I have never seen one. Such was the apparent popularity of the black beauty. In my opinion, the 120X has a better S-meter than the 129X. In performance, the 120X crystal filter is virtually the same as the crystal filter in my HQ–150. [Hammarlund used the same crystal filter design in almost all their receivers from 1938 until they quit making receivers, see "Full-range selectivity with 455-Kc quartz crystal filters," by D. Oram, *QST* **XXII**, 12 (Dec. 1938), 33–36, 56–62. Ed.] Using the 120X for a main receiver would be kind of like using a Bugatti T101C as your main car, but the 120X does outperform many current solid state receivers. A digital readout and high-Q preselector or antenna tuner would make it unbeatable in most situations. The 120X was the receiver of choice by the top BCB DXers of the era. [This means it was probably popular among hams and SWL's, too. Ed.] Many 120X's were sold to the government during WWII, which may explain the low survival rate of these fine pre-war communications receivers. My 120X was purchased at Dayton a few years ago. Shortly thereafter a transformer lead arced (old brittle insulation) and took a filter choke with it. The 120X fuse was too high, my second bad experience with an improperly fused receiver. [Let this remind us all that the *first* thing you should do with a newly arrived piece of gear is determine if it is fused correctly. Ed.] I eventually rebuilt the power supply and replaced all of the old wax impregnated tubular capacitors. But there are obstacles to restoring any similar set, including difficulty of obtaining high voltage transformers and chokes, and spatial problems when rebuilding a power supply. (W. T. Farmerie) [Based on *QST* ads, the 120 has 12 tubes, tunes 0.54–31 mHz continuously in 6 bands with 310 degrees of bandspread calibrated for the 80–10 meter ham bands, is single conversion, has a 6 position 455 kHz crystal filter with phasing control, and has a diode noise limiter. Ed.]

COLLINS 51J-4: The Collins 51J series of communications receivers were designed in the late 1940's and built from about 1949 until the early 1960's. The R–388 military version of the J3 was produced from about 1952 onward. The J4 is a J3 with a mechanical filter conversion kit. Conversion kits are still available throught the Yellow Sheets, but converting a J3 is not a cost effective way to get a J4. The earliest date I have seen on a J4 instruction book (manual) is 1957 (maybe the start of J4 production); it was a 3rd edition, 1 February 1958. Another J4 instruction book I have seen had no dates, but perhaps was missing some pages. The cutoff date for J4 production was about 1962. I do not know how meany J4's were produced, or if serial numbers are an accurate indication of the total number produced. I have personally inspected two J4's, one a 1960 model

based on date codes with serial number 1998, and the other a 1959 model based on date codes with serial number 5001D. The serial numbers were stamped on a small metal tag mounted with screws to the front panel, so tags could have been switched. This is not as unlikely as it might seem. For example, I know that tag switching has been done on R-390A's, having seen Collins tags on R-390A's made by other companies. Of course, the owner or seller looks silly claiming to have a Collins R-390A when all the subchassis have another name painted on them (Motorola, Electronics Equipment Corp., et al.). I am not sure what motive there would be for tag switching on J4's. Perhaps a premium is placed on high serial number J4's like is done with 75A4's. The 51J design is directly related to the 75A series of ham band only receivers, and evolved indirectly into the Collins S-line. It takes only a glance to see that the 51J design also evolved into the R-390 series of military receivers. The gears, cams, and racks are laid out differently, the 51J VFO PTO is smaller, the 51J has no quick release subchassis, and the 51J IF frequency is 500 kHz rather than 455 kHz as in the R-390 series, but the family resemblance is unmistakable.

The 51J series receivers tune 0.5 to 30.5 mHz in 30 bands of 1 mHz each with about 30 kHz of over range at each end, beginning with band 1, 0.5–1.5 mHz, and ending with band 30, 29.5–30.5 mHz. The 51J series receivers weigh about 43 pounds sans cabinet, and require 10.5" high and 13.5"deep mounting space. The width is standard 19" rack mount. The tubes are (2) 6AK5, (3) 6BE6, (8) 6BA6, (2) 12AX7, 12AU7, 6AQ5, 5V4, and OA2. The front panel controls are RF GAIN, AUDIO GAIN, BFO ON-OFF, CALIBRATE ON-OFF, BFO PITCH, AVC ON-OFF, LIMITER IN-OUT, ANT. TRIM, CRYSTAL FILTER SELECTIVITY 0(off)-1-2-3-4, CRYSTAL FILTER PHASING, OFF-ON-STANDBY, BAND CHANGE, KILOCYCLE TUNING, ZERO ADJ., METER INPUT(signal level)-OUTPUT(audio level), CAL.(100 kHz calibrator screwdriver adjust), and in the J4 a filter selector 1-3-6 (1.4, 3.1, and 6.0 kHz bandwidths) for optional mechanical filters. The J1 did not have an antenna trimmer or front panel calibrator screwdriver adjustment. I do not know about the J2. The J3 and R-388 controls are identical to the J4 except for the mechanical filter selector. There is a mechanical filter conversion kit which may be used to convert a J3 or R-388 to a J4. Collins rated the sensitivity of the J4 as 6 to 10 microvolts on band 1, and between 2 and 4 microvolts for the remaining 29 bands for a 10 db signal to noise ratio. The 51J used three different conversions schemes, one for band 1, a second for bands 2 and 3, and a third for bands 4 through 30. I won't try to explain the conversion schemes here, but refer you to the R-388 manual, Department of the Army Technical Manual TM 11-854, or Department of the Air Force Technical Order TO 16-35R-388-5, "Radio Receiver R-388/URR," April 1952. J4 manuals do not have an adequate description of the conversion schemes.

Collins did a terrible thing with their design of band 1, at least if you are a BCB DXer like me. They desensitized it. You only have to glance at the RF-mixer tuning for band 1 and compare it to the other bands to see that something strange has been done to band 1. The 10K ohm resistor R105 and 3pf capacitor C117 stand out like sore thumbs. There is, fortunately, an easy to describe cure, although not so easy to actually do. Add a 0.01 mfd, 1KV disc ceramic capacitor in parallel with C117. Anyone interested in this mod may drop me a SASE with a note requesting details of the mod and I'll send a complete description. With this mod my J4 came alive on band 1. If you want to try out the mod before you go to the trouble to do it permanantly, run down to Radio Shack, buy a pair of mini test clips, catalog number 270-372A, solder the leads of a 0.01mfd, 1KV disc ceramic capacitor to them, and clip them across C117 with your J4 on its side. Either insulate the capacitor leads, or be sure that they do not touch any nearby switch lugs.

A potential cause of 51J insensitivity on all bands, especially on the higher SW bands, is R149, 680 ohms on my schematics, which runs from one side of R148, the 10K pot RF gain control, to ground. The DC voltage drop from the junction of R148 and R149 to ground should be -1.40 VDC under no signal conditions (antenna disconnected) with AVC on. If it is not, and if the voltage is significantly greater, say in the -1.70 to -2.00 VDC

range or higher, then your 51J will probably be insensitive on all bands, and your 51J S-meter will probably read low, say not above 80 db on even the strongest signals with an 80 to 100 foot long wire antenna. The cure for this problem is to replace R149 with a resistor which gives a –1.40 VDC voltage drop. Remove R149 (it should be on a three lug terminal strip near where the power cord enters the chassis rear), temporarily wire in a suitable variable resistor, say a 1K pot, 1/2 watts or more, adjust the pot for a –1.40 VDC voltage drop, remove the pot, measure the resistance, and install a fixed carbon resistor, 1/2 watt or greater, as close to the measured value as possible. In my experience the voltage can be anywhere between –1.30 and –1.50 VDC. I used two 1K ohm, 1/2 watt resistors in parallel, with measured resistance of 517 ohms, and measured voltage drop of –1.30 to –1.35 VDC depending on the time of day (power line voltage varies rather widely here in Ruston). It is probably better to be a little on the low side rather than on the high side.

Another potential cause of insensitivity on all bands is R187, a 10K ohm screwdriver adjustable pot with lock nut beside the BFO pitch shaft, which determines the gain of the 3rd IF amplifier. My manuals have no instructions for setting R187. I have assumed the correct setting is determined by the J4 (500 KC) IF performance test per paragraph 5.3.7. In my experience, the 500 KC IF performance criterion is met with R187 set near minimum resistance (nearly maximum gain of the 3rd IF amplifier). For J3's and R–388's this setting may be considerably different because the J4 has mechanical filters which in turn have considerable insertion loss. If anyone has any information or opinions on this, please write me so that we can share the information with other hollow staters.

Measured sensitivity of a modified J4 using a URM–25D precision RF signal generator after the band 1 mod and R149 mod was 3 microvolts for band 1, 0.7 microvolts for bands 2 and 3, and between 1 and 3 microvolts for bands 4 through 30 for a 10 db signal to noise ratio. I did not measure band 1 sensitivity before the band 1 mod, but I doubt the sensitivity was anywhere near the 6 to 10 microvolts specified by Collins, and probably more like 25 to 100 microvolts or worse. As J4 users I have talked with have said, and I agree, (unmodified) J4 band 1 sensitivity is usually lousy. It could be that the band 1 sensitivity figures stated by Collins in the J4 manual are actually for the J3 and Collins never bothered to measure the J4 band 1 sensitivity. The insertion loss of the mechanical filters could easily degrade band 1 sensitivity to the degree observed. This would also explain why DXers judge band 1 sensitivity as perfectly acceptable for a J3 or R–388. Curiously, another J4 I have used does not seem to have significant band 1 insensitivity, so it may not be a problem with all J4's.

How does the J4 stack up against our favorite boat anchor, the R–390A? Quite well, and in some cases slightly ahead. The J4 has no expensive and difficult to find ballast tube. Based on my experience with a sample of two J4's, the J4 seems to have somewhat less warm up drift than R–390A's I have used. Once warmed up, both are rock solid. The 43 pound J4 weight is a definite plus, about half that of an R–390A. J4 audio output is 4 ohms for speakers or 600 ohms for line output, and J4 audio quality seems better than R–390A audio quality. One J4 I have used has annoying spurs which seem to be IF feedthrough and harmonics at 0.5, 1.0, 1.5 mHz, and so on, with decreasing intensity up to about 4.5 mHz. The 500 kHz harmonic spurs seem to be caused by missing top and bottom dust covers. Another J4 I have used has both dust covers and does not have significant 500 kHz harmonics, only a weak het at 500 kHz. So I would recommend that you avoid J4's or any other 51J series receiver without dust covers. Neither the J4 nor the R–390A has a clear win with regard to selectivity bandwidths. The 6.0 kHz filter in the J4 seems optimal for pleasure listening on the SW bands. But I don't have enough experience yet to know if the 3.1 kHz filter in the J4 is adequate for for difficult DX situations. The J4 crystal filter may be switched off (position 0) or set to bandwidths of approximately 3–4 kHz, 1.25–1.6 kHz, 0.5–0.7 kHz, or 0.3–0.5 kHz (positions 1–4) in conjunction with the 6.0 kHz mechanical filter. Narrower bandwidths are obtained with the 3.1 kHz and

1.4 kHz mechanical filters. For example, with the 3.1 kHz mechanical filter, Collins rates the J4 selectivity in crystal position 1 as 2.25–2.75 kHz. So you have a wider choice of selectivity options than you might think. The J4 crystal phasing control is the best I have used, better than the standard Hammarlund crystal filter, just like a notch filter, which gives the J4 an edge over the R–390A in some situations. The J4 BFO pitch knob is not calibrated, as it is on the R–390A. The J4 has only one AVC attack and release time, so it is not easy to convert it into a SSB receiver and retain its AM capabilities. And the J4 does not have a narrow audio filter, though one could be added outboard. Thus, an R–390A with Cornelius SSB mod is a clear winner in the CW and SSB categories. Both J4's I have used have a slight amount of backlash in the KILOCYCLE tuning which I believe is due to the coupler which connects the KCS and PTO shaft. The coupler resembles an R–390A Oldham coupler, but without anti-backlash spring (or spring shafts in case you wanted to add a spring), and with set screws rather than non-mar clamps. So for ease of PTO adjustment with no backlash, the R–390A comes out ahead. The J4 has a 500 kHz IF output, so you can add external IF processing like the Hammarlund HC–10 converter, which would give you more bandwidths and SSB with a product detector. I haven't tried this, so I don't know if just connecting an HC–10 provides effective SSB reception. You may still need to modify the J4 AVC. There is an AVC attack and release time mod described in W. I. Orr's *Ham Radio* article (Feb. 1978, pp. 66–69), "Modifying the Collins 51J receiver for SSB reception," which can be developed into a switched AVC mod. The J4 has plastic knobs, plactic KCS dial, and a bakelite drum covered with a decal which flakes off for the MCS dial. The J4 MCS dial is difficult to read because of poor #47 bulb positioning and glare reflected from the glass window. For viewing ease and dial durability the R–390A is by far the winner. Most J4 front panels are St. James gray (it looks black to me) with white silk screened lettering. The paint is finely textured, somewhat like black wrinkle varnish which the military used on much of its gear. The J4 was also available in a light gray, "FAA green," and perhaps other special order colors. I have not seen any of the other colors, but I doubt they are as appealing to the eye as the St. James gray.

Collins made a matching cabinet for the J4, but apparently few J4's were originally purchased with one. Most J4's nowadays will be without a cabinet. I liked my first J4 so much that I bought it a new Bud cabinet, called a Delux Cabinet Rack, Bud type CR–1740, 14.75" by 22" by 12.3125" (D by W by H) with 10.5" panel height, painted metalic gray, louvered sides, with hinged liftable lid and sliding flush latch, including special 10-32 large head diameter Phillips screws. This J4 came with special 10-32 rack mounting screws which I used, but the fancy mounting screws Bud included show attention to detail. The cabinet rear had a spot welded metal plate which restricted air flow and limited access to the J4 chassis rear. It had to go. So I drilled through the spot welds and removed it. Also, the tapped cabinet rack mounting rail holes did not align with the J4 front panel cutouts. Fortunately, they were uniformly too high. So I raised the J4 slightly by installing two 1.5" wide by 3/32" thick aluminum strips bolted to the cabinet bottom. After slightly repositioning the J4 front panel (by loosening the front panel mounting screws), it all fit perfectly. At first I was irritated at having to modify my brand new Bud cabinet, but now I like the the aluminum plates because they prevent paint from being scratched off the cabinet bottom when the J4 is removed from or placed in the cabinet. If you take this approach to getting a cabinet for your J4, be sure to measure the alignment of the rack mount cutouts before you select the aluminum strips thickness. I cannot guarantee that 3/32" is the correct thickness for all Bud cabinets and J4's. I used drill bits and a micrometer to determine the required thickness. I would probably use 2" wide plates if I did it again because the 1.5" plate widths leave little tolerance for errors. You can do without the strips if you don't bother to bolt the J4 in the cabinet. Because of the cost, about $150 for a new Bud CR–1740 Delux Cabinet Rack, and because of the labor involved, you are better off getting a J4 with a matching cabinet even if it means paying a premium price. (Dallas Lankford)

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PUBLISHER'S AND EDITOR'S CORNER

Greetings hollow staters and boat anchor lovers wherever you are. For some time we have wanted to do a special issue on test equipment, so here we go. Maybe we can even entice you to share your experiences with test gear by relating some of Dallas' adventures with a pair of AN/URM-25D RF signal generators he got last spring and a TV–2/U tube tester he got at at Ham Com 88 last June. Also, we have asked Joe Bunyard to compare notes with us on the TV–2/U and to provide us with information about the TV–7 tube tester. When all of this is combined with some short reviews of the Eico models 324 and 377 RF and audio signal generators, we should have a good introduction to tube test gear. We don't use VTVM's. Digital multitesters, like the Beckman DM25 with 2% accuracy, are much more convenient and accurate for voltage and resistance measurements. The DM25 also includes a built-in digital capacitance meter with 5 ranges, from 2 nf to 20 mf, which is very useful and accurate except below about 15 pf.

SHORT CONTRIBUTIONS

TUBE TESTERS: I know I have bad-mouthed tube testers in the past because good tubes may test bad and vice versa, but I never denied using them. At the very least, tube testers are useful for identifying dead or nearly dead tubes. It used to be relatively easy to find tube testers, such as at Radio Shack and even at convenience stores. But about two years ago these public tube testers were removed from service. So I purchased a tube tester and have found it indispensable for trouble shooting hollow state gear and for building my tube inventory. Below is a survey of three of the most common military surplus tube testers, any one of which would suffice for a hollow stater's basic tube testing requirements. (Dallas Lankford)

- TV-10A/U
  manual: NAVSHIPS 93069, "Technical Manual For Electron Tube Test Set TV-10A/U," 4 October 1957
  supplementary manual: "Supplementary Test Data For Older Tube Types," Hickok Part No. 3200-96, 11-1-63
  dimensions: 7" by 18.4" by 10.4" (D by W by H)
  weight: 23 pounds
  power required: 105–125 VAC, 50–1,000 Hz, single phase, 100 watts at 60 Hz
  tubes required: 5Y3WGTA, 83 (subsitute 5Z3)
  fuse required: 250 VAC, 1 A, normal instantaneous
  bulbs required: NE-51, 47, 49, 81
  sockets: 7 and 9 pin miniature, loktal, 4, 5, 6, and 7 pin, acorn, 7 and 8 pin subminiature
  meter ranges: 0–3,000, 0–6,000, 0–15,000, 0–30,000 micromhos
  miscellaneous: detachable top (side), built-in roll chart, 829A adapter (E101), 2C39 adapter (E102), test leads (W101 for grid & plate of lighthouse tubes, W102 for plate, W103 for grid)

The TV-10A/U is my primary tube tester. It is small, light weight, and easy to use. I got mine in January 1987 from Fair Radio together with a partial reproduction of the manual, the supplementary data, and, after some whining, a parts list. I don't understand why Fair Radio deleted the parts list from their partial reproduction because some crucial parts values are not listed on the schematic or anywhere else in the manual except in the parts list. My TV-10 was missing all adapters and all but one of the test leads. Because I only test 7 and 9 pin miniature, octal, and a few 4 pin tubes, I did not make a fuss about the missing adapters and test leads. If such adapters are critical to your needs, you should make them a condition of the sale in advance. Like any piece of gear that is 20 to 30 years old, it has required some maintenance and repairs. An immediate problem was an intermittent loss of contact on one or more of the pins of the 9 pin miniature socket. A temporary fix was to bend the contacts closer together with a small dental tool. Eventually I replaced the socket because of recurrence of the problem. Fair Radio sells unused and used mil spec sockets which I recommend for this purpose, especially Eby and Cinch sockets. I recommend against newly manufactured miniature tube sockets. Apparently Americans have forgotten how to manufacture high quality miniature tube sockets, and even used sockets 30 years old are preferrable provided they are in good condition. I elected to redo a poorly done OFF-ON toggle switch replacement which used a toggle switch with binding screw lugs instead of solder lugs as in the original. It turned out that not any toggle switch would do. A small one with lugs which would clear the nearby power transformer was required. The color coded leads of CR101, a fancy little low voltage copper oxide bridge rectifier which determines the calibration of the TV-10, had been unsoldered at some point in the past and resoldered poorly, so I redid that solder work, too. Apparently someone had tested CR101 per the manual in an attempt to determine why the plate voltage measured higher (about 175 VDC) than specified by the manual (150 VDC). The

higher than normal plate voltage, which may be an inherent feature of TV–10's, apparently causes it to indicate erroneous transconductances which are high by as much as 10 to 20% depending on the condition of the 83 (5Z3) tube. The original roll chart window had been replaced with a poorly done homebrewed window, a line scratched on a thin piece of clear plastic and a broad red line drawn above the scratched line with red felt marker. You could hardly read the tube data. So I replaced that with an improved homebrewed roll chart window made with my typesetting software and printed with my laser printer on a sheet of overhead projector transparency. The end result is quite nice, though perhaps not as nice as the original, which was probably a plexiglass window with engraved and painted parallel lines. The TV–10 is moderately difficult to remove from its case because of a continuous metal rim which runs around the inside of the case and to which the front panel is bolted. Some tube socket wiring can easily become pinched between this metal rim and the front panel unless care is used when replacing the TV–10 in its case. The 83 tube is about $15–20, but generally available. The 5Z3 is an acceptable substitute and inexpensive. The 49 and 81 lamps are difficult to find and about $1 each. (Dallas Lankford)

- TV–7( )/U

  manuals: Department of the Army Technical Manual TM 11-6625-274-12, "Operator's And Organizational Maintenance Manual, Test Sets, Electron Tube TV-7/U, TV-7A/U, TV-7B/U, and TV-7D/U," Department of the Army Technical Manual TM 11-6625-274-35, "Field And Depot Maintenance Manual, Test Sets, Electron Tube TV-7/U, TV-7A/U, TV-7B/U, and TV-7D/U"
  test data manual: Department of the Army Technical Bulletin TB 11-5083-1, Department of the Air Force Technical Order TO 33AA21-5-1, "Test Data For Electron Tube Test Sets TV-7/U, TV-7A/U, TV-7B/U, and TV-7D/U," Changes No. 3, 10 February 1960 (and later versions, e.g., TB 11-6625-274-12/1, Jan. 1962)
  dimensions: 6.5" by 15.5" by 8" (D by W by H)
  weight: 18 pounds
  power required: 103.5–126.5 VAC, 50–1,000 Hz, single phase, 45 watts at 50 Hz
  tubes required: 5Y3WGTA, 83 (substitute 5Z3)
  fuse required: none (81 lamp serves as fuse)
  bulbs required: NE-45, 47, 81
  sockets: 7 and 9 pin miniature, loktal, 4, 5, 6, and 7 pin, acorn, 7 and 8 pin subminiature, 7 pin transmitting (for 813, etc.)
  meter range: 0–120% good (can be converted to 0–30,000 micromhos provided rated tube transconductance is known)
  miscellaneous: detachable top (side), built-in 7 and 9 miniature tube pin straighteners, 7 and 8 pin long lead subminiature adapter (E104), 3E29 adapter (E105), 2C39A adapter (E107), test leads (W101 and W102)

The TV–7 is basically a smaller, lighter TV–10, but with a book of tube test data instead of a roll chart, and a meter which reads in % good rather than directly in micromhos. The tube test data manual may be yellowed with age and disintegrating. In any case, you should consider making a Xerox copy of the tube test data manual and storing the original in your files. Because it is small and compact, some TV–7 repairs would be very difficult. The tube, 81 lamp, and chassis replacement comments in the TV–10 discussion above also apply to the TV–7. The NE-45 lamp is expensive and difficult to find. (Joe Bunyard and Dallas Lankford)

- TV–2( )/U

  manuals: Department of the Army Technical Manual TM 11-6625-316-12, "Test Sets Electron Tube TV–2/U, TV–2A/U, and TV–2B/U," March 1961; Department of the Army Technical Manual TM 11-6625-316-35, Department of the Air Force Technical Order TO 33AA21-4-12, "Field And Depot Maintenance Manual, Test Sets, Electron Tube TV–2/U, TV–2A/U, TV–2B/U, and TV–2C/U," Sept. 1961

dimensions: 8.4" by 16.1" by 17.7" (D by W by H)
weight: 37 pounds
power required: 103–126 VAC, 50–1,000 Hz, single phase, 70 watts (no tube under test)
tubes required: (2) 6X4, 83 (substitute 5Z3)
fuses required: (2) 250 VAC, 3 A, normal instantaneous
bulbs required: (2) NE-51
sockets: 7 and 9 pin miniature, loktal, 4, 5, 6, and 7 pin, acorn, 7 and 8 pin subminiature, 7 pin transmitting (for 813, etc.)
meter range: 0–150% good (can be converted to 0–60,000 micromhos provided rated tube transconductance is known)
miscellaneous: detachable top (side), roll chart and 7 and 9 miniature tube pin straighteners built into detachable top, 2% accuracy, filament, grid bias, plate, and screen voltages are individually metered and adjustable, built-in test leads with clips, built-in 7 and 8 pin long lead subminiature adapter, –4 to 125 degrees Fahrenheit operating temperature range

The TV–2 is larger, heavier, and more complicated to set up in order to test a tube than the TV–7 or TV–10. But it is the only one of the three which measures transconductance and other tube parameters accurately, within 2% according to manual specifications. To measure transconductance of a tube you set about the same number of switches as in the TV–7 or TV–10, but, in addition, you fine adjust individually metered filament, grid bias, plate, and screen voltages with rheostats. Consequently, it takes more time to test a tube with the TV–2. Once the controls and adjustments are made, it takes no more time to test several tubes of one fixed type than with a TV–7 or TV–10. Provided you can find exact or nearly exact replacements parts, the TV–2 is the easiest of the three to repair. There is often (but not always) more space between parts, and a tilt-out chassis provides additional access. Some parts, in particular the 250 ohm 50 watt rheostats, are no longer manufactured, but a 225 ohm 50 watt rheostat seems satisfactory in one repair we made. The replacement rheostat was slightly larger than the original, which made it necessary to partly unlace a wiring bundle so that the wires could spread out an allow more space. Meter replacement can also be a problem. Fair Radio currently sells unused ("new" is not an accurate description of a 25 year old meter) screen voltage meters, but it took us four tries to get one which worked correctly. The replacement meters did not have a spherical glass window like the original. The original meter and 3 of the "new" replacement meters were "sticky." The meter needles jumped discontinuously as the voltage was adjusted, and would occasionally hang at some rather high voltage even with the TV–2 turned off. A small amount of discontinuous meter movement is normal because wire wound rheostats are used to adjust the voltages. We were lucky to find an unused 7 pin ceramic transmitting tube socket at Ham Com 88 for $2 to replace a cracked socket in one TV–2. Davilyn sells these sockets for $20, while Surplus Sales of Nebraska wants $90. Some of the electrolytic capacitors and many of the precision resistors in a TV–2 can probably only be obtained from another TV–2. Nevertheless, if you want the best, the TV–2 is it. (Joe Bunyard and Dallas Lankford)

SIGNAL GENERATORS: If you own a hollow state receiver, you really should have a signal generator for occasional alignment and trouble shooting. The Eico models 324 and 377 RF and audio signal generators are adequate for basic signal generator requirements. For precision measurements, any one of the AN/URM–25( ) family of military surplus RF generators offers good performance in a relatively small and light weight package. The Hewlett-Packard 606A, somewhat larger and heavier than the URM–25, appears to be a reasonable alternative, but I have no personal experience with it. Most receivers do not require a precision RF generator. The only receiver I have encountered which does is the 51J4, cf. the 500 kHz IF performance measurements in paragraph 5.3.7 of the manual. (Dallas Lankford)

- Eico Model 324
  manuals: "Instruction Manual, Model 324," "Construction Manual, Model 324, Signal Generator"
  dimensions: 4.8" by 10" by 8" (D by W by H)
  weight: 10 pounds
  power required: 105–125 VAC, 50–60 Hz, 15 watts
  tubes required: 12AU7, 12AV7
  fuses required: none
  bulbs required: 47
  frequency range: 150 kHz to 145 mHz continuously in 6 bands, 111 mHz to 435 mHz on calibrated harmonics
  RF output voltage: not specified
  output impedance: not specified
  types of modulation: none, 400 Hz internal at 0–50% adjustable, 1,000–15,000 Hz external
  miscellaneous: special Amphenol male and female RF output connector and plug (Amphenol type numbers not listed in manual)

I have used the Eico 324 for about 10 years as my main RF signal generator. It is small, light weight, and easy to use. I seem to recall replacing one or two electrolytic capacitors in the power supply at some point in the past, which is not uncommon for an aging piece of equipment that has been seldom used. (Dallas Lankford)

- Eico Model 377
  manuals: "Operating Manual, 377 Sine / Square Wave Audio Generator," "Assembly Manual, 377 Sine / Square Wave Audio Generator"
  dimensions: 7.7" by 11.2" by 7.2" (D by W by H)
  weight: 11 pounds
  power required: 105–125 VAC, 50–60 Hz, 50 watts
  tubes required: 6SJ7, 6AQ5A, 6FQ7, 6BQ5
  fuses required: none
  bulbs required: 47, 3S6-3W (G.E. lamp designation, 130 VAC, 3 watt lamp with small threaded base)
  frequency range: 20–200,000 Hz continuously in 4 bands
  RF output voltage: depends on load impedance, typically 10 volts maximum into 1,000 ohms, continuously adjustable
  output impedance: 1,000 ohms
  types of modulation: none
  miscellaneous: bananna plug / binding post output connectors

I got the Eico 377 for aligning the 60 kHz IF in the HQ–180A. I have never had an opportunity to use it for anything else. It is small, light weight, and easy to use. The 3S6-3W lamp is difficult to find (and essential for operation of the 377 as it apparently functions as a cathode resistor for the 6SJ7 oscillator). I believe I replaced one or two electrolytic capacitors in the power supply at some point in the past. (Dallas Lankford)

- AN/URM–25D
  manuals: Department of the Army Technical Manual TM 11-5551-D, Department of the Air Force Technical Order TO 33A1-8-12-1, "R.F. Signal Generator Set AN/URM–25D," March 1956; Department of the Army Technical Technical Bulletin TB 11-6625-697-35, "Calibration Procedure For Signal Generator AN/URM–25, AN/URM–25A, AN/URM–25B, AN/URM–25C, AN/URM–25D, AN/URM–25F, AN/URM–25G, AN/URM–25H, AN/URM–25J, AN/URM–25K, And AN/URM-25L," 30 July 1976
  dimensions: 10.8" by 14" by 10.3" (D by W by H)
  weight: 37 pounds

power required: 103.5–126.5 VAC, 50–1,000 Hz, single phase, 48 watts
tubes required: (3) 6AH6, 6AG7 (substitute 6AK7), 5726, 5750, 5814, OA2, 6X4W
fuses required: (2) 250 VAC, 1 A, slow blow
bulbs required: (2) 323 (Chicago Miniature brand, 3 V, 0.19 A, base P, bulb T-1$\frac{1}{4}$)
frequency range: 10 kHz to 50 mHz continuously in 8 bands
RF output voltage: 0.1–100,000 microvolts continuously adjustable, metered, better than 10% accuracy when terminated by a 50 ohm load, 2 volts adjustable across a high impedance load
output impedance: 50 ohms, 500 ohms
types of modulation: no modulation, 400 Hz internal at 0–50% metered, 1,000 Hz internal at 0–50% metered, 1,000–15,000 Hz external
adapters and attenuators: CN-223 fixed 5:1 attenuator, CN-224 fixed 10:1 attenuator, CX-1363 test lead adapter, MX-1487 impedance adapter, SM-35 antenna simulator
miscellaneous: detachable top (side), RG–58/U cables terminated in BNC connectors (can be homebrewed)

The 25D has four main disadvantages: the special screw base 323 bulbs which illuminate the dial are difficult to find and expensive; the precision step attenuator often has been damaged by improper use and it is extremely difficult to obtain and to replace the required precision 1/8 watt resistors; there are nine paper capacitors which should (and in some cases may have to) be replaced and it is difficult to obtain and to replace them; some (most or all) of the fixed attenuators and adapters are frequently missing and it is extremely difficult to obtain replacements. The 1 mHz calibrator signal has objectional hum, and some (most or all) will not zero with WWV. There is often (usually or always) considerable backlash in the main tuning, as much as 2 divisions of the 100 division scale, which makes the frequency interpolation scale useless. Manuals, parts, attenuators, and adapters are generally not interchangeable among the URM–25 models. The 25D fixed attenuators and adapters can be rebuilt. Each female BNC screw-in connector is locked in place with an Allen set screw in one of the screw holes used to secure the removable cover. We use a male BNC connector as a wrench to remove or replace a good female BNC connector. Otherwise, a good female connector may be bent out of round during removal or replacement. Some 25D screw-in BNC femals connectors are marked UG–625/U. Apparently there has been a number change since the 1950's because current UG–1094/U's are equivalent to these old style UG–625/U's. Don't be fooled by the superficial good appearance of the paper capacitors with phenolic cases that resemble old style brown colored silver mica capacitor cases (made by Micamold in our 25D's). All are probably leaky, and some may be shorted or open as in one 25D we overhauled. We used 1KV disc ceramics for the 0.01's we replaced, and 600 VDC yellow wrap metalized film tubulars for the larger capacitance values (available from Antique Electronic Supply; see *HSN* **19**). The precision step attenuator can also be rebuilt if you can find the required 1% precision 1/8 watt resistors. We recommend that you try to avoid this exceptionally difficult rebuilding by making a good precision step attenuator a written precondition of your purchase. You should probably include a good meter in the terms of your purchase. One of our 25D's had a sticky meter needle which moved discontinuously as the MICROVOLTS carbon potentiometer was adjusted. We were fortunate to obtain a good used exact replacement from Fair Radio. The meter case rear had some corrosion, but we figured that would not effect performance because the meter was sealed. After sanding and painting with clear exterior varnish, the meter case rear looked fine. In summary, if you are willing and able to do some difficult overhaul work, a URM–25D may be the best compromize with respect to size, weight, price, and availability of the military surplus precision RF signal generators. One of the other URM–25 models would probably be an acceptable substitute for a URM–25D. We like the D model best. (Joe Bunyard and Dallas Lankford)

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PUBLISHER'S AND EDITOR'S CORNER

One of our subscribers sent us a clipping from the December 1988 issue of *Popular Communications*. A *PopComm* subscriber had written the editor for information about R–390A's, and in response, among other things, the editor said, "For all its mystique, modern solid-state communications receivers in the $500 price range will outperform the R–390A by a mile." As anyone knows who has compared a R–390A side by side with solid state communications receivers, including the very best in the $1000 price range, that is not true. The *PopComm* editor also said, "Within the military, the R–390A was ditched long ago ...," but apparently that is not true either. Although we have not actually seen a R–390A in current use by the military with our own eyes, we have been told (*HSN* 16) that the R–390A is still used by the military, especially on large ships where high RF levels are encountered. Also, it would not surprise us if the military has kept R–390A's on hand for WW III. EMP (electromagnetic pulse) would probably disable every piece of solid state

communications equiplemt in the first few minutes of WW III. But unless it was melted by a fireball, or made inoperative from the stress of a nearby blast, a R–390A would continue to function as long as there was AC power.

SHORT CONTRIBUTIONS

WANTED: Are there PL-259 to C male connector adapters, or SO-239 to C male connector adapters, and if so, where can I buy them and how much do they cost? (Felipe Flosi, Rua Senador Vergueiro 232/504, Rio de Janeiro - RJ, CEP 22230, Brazil) [Did I paraphrase your question understandably? Anyway, I don't know of any such connector adapters. If anyone does, please contact Felipe and me. Ed.]

WANTED: I find the R–390A to be one of the best receivers ever made, and will never replace it with one of the Japanese day-flies. But investigations have been made showing that the radium coating of the instrument pointers is *dangerously* radiating. [Who made these investigations? Did they measure the radiation? Ed.] Can you give me a hint where to obtain meter that fit into the front panel which are not radiating? (Reinhart Mazur, D-8133 Feldafing, Am Kirchplatz 7a, West Germany) [First, the meters are not dangerous according to measurements I made; see the article in *HSN* **19**. Next, I don't know how to dispose of the meters safely, so it is best to leave them in your R–390A. Finally, I have searched almost every electronics catalog for the last 10 years, and I can't find any replacements. I'll list the meters specifications below in case others want to join in the search for new replacement meters for the R–390A. If anyone knows anything more, please contact Reinhart and me. Ed.]

R–390A METERS SPECIFICATIONS: The R–390A line meter is 250 microamps full scale, 3360 ohms internal resistance. The R–390A carrier meter is 1 milliamp full scale, 17.7 ohms internal resistance. These parameters were measured using a DVM with 2% accuracy. You should not try to measure the internal resistances directly because your ohm meter will almost certainly pin the meters, which may damage them. To determine the internal resistances, I measured the voltages across the meters at full scale, using a 9 volt battery in series with a 500 K ohm pot to adjust the meters to full scale. Then I measured the currents at full scale. The internal resistances were calculated using Ohm's Law. For example, one of my carrier meters measured 17.7 millivolts and 1.00 milliamps at full scale. Ohm's Law is $V = IR$, from which we get $0.0177 = 0.001R$, and solving for R gives $R = 17.7$ ohms. A carrier meter in one of my R–390A's which gave readings 20 db below normal on strong signals measured 19.2 ohms. So even a small error (high or low) in the internal resistance of a carrier meter will cause rather large errors in carrier meter readings. (Dallas Lankford)

WANTED: Does anyone know where I can purchase the book *50 Years of Collins Radio*, or would someone loan me a copy? (Walter Hann, Neubaugasse 23/9, A-9300 St. Veit/Glan, Austria, Europe)

51J4 MODS ?: The following is taken from my 10 page article "Collins 51J4 Technical Notes" and is available from me for two $1 bills and a SASE with enough stamps for two ounces. Please do not send me a $2 check, or a money order, or foreign currency, or stamps without an envelope, or an envelope without your name, address, and stamps on it. The article includes alignment, PTO end point adjustment, replacement of dial cords, and more.

I don't use my J4 as a backup for a solid state RX as Fritz does because I don't own any solid state communications receivers at present. I have temporarily owned or used some very good solid state RXes, including a SPR–4 with 5–NB noise blanker, and a NRD–515 with Collins mechanical filter mod. But none of them had quite as good weak signal performance as top of the line tube receivers. So it doesn't surprise me that a J4 would outperform an ICOM R–71A in some difficult listening situations as Fritz observed.

Fritz mentions that performance figures may prove the R–71A is a better RX than the J4. But performance figures often do not tell the complete story. For example, several years ago as part of their catalog Sherwood Engineering included a large number of laboratory measurements for many top RXes. There it was pointed out that receiver manufacturers typically measure dynamic range with two signals spaced 20 kHz apart. However, in difficult AM listening situations the carriers are much closer together, sometimes as little as 2 kHz apart. So Sherwood Engineering measured dynamic range twice for each receiver, once at 20 kHz and a second time at 2 kHz test signal separations, and called these measurements wide and narrow dynamic ranges. The results were revealing. For a R–390A the wide and narrow dynamic ranges were 81 and 79 db respectively, while for a NRD–515 they were 95 and 77 db respectively. Both a R–70 and a R–71A measured 86 and 62 db respectively. The J4 was not included in Sherwood's list. But in any case, I agree with Fritz that a J4 is generally the equal of any solid state RX, and perhaps slightly superior to any solid state RX for DXing foreign splits. Similar comparisons have been made with other receivers, such as Chuck Hutton's comparison of a Drake R7 and R–390A in *DX News* 47, 1 (Oct. 8, 1979), with similar conclusions.

In my review I mentioned that many J4 users, including me, have complained about insensitivity, especially on band 1, and I described two simple modifications for improving both band 1 and overall sensitivity. The band 1 mod was my own idea, while the R149 mod to improve overall sensitivity was originally suggested by William I. Orr in his February 1978 *Ham Radio* article, "Modifying the Collins 51J receiver for SSB reception." I began to have doubts about these mods several weeks ago when I noticed that both of my J4's had cross modulation from KRUS 1490 on WLAC 1510.

To learn more about the J4 cross modulation problem, I built a hybrid coupler so that I could measure the dynamic ranges of my receivers. The definitive article on measuring dynamic range is Wes Hayward's July 1975 *QST* article, "Defining and measuring dynamic range." The hybrid coupler which I built is described in Hayward's article, except I used an Amidon FT-82-61 ferrite torroid core with 17 bifilar turns to extend the coupler frequency range to include the BCB. One of my R–390A's measured 82 db (which is within 1 db of the value reported by Sherwood), one J4 (with only the R149 mod) measured 72 db and the other (with band 1 mod and R149 mod) measured 67 db, and my HQ–180A (the surprise winner) measured 88 db dynamic range. I used a pair of URM–25D signal generators with test signals at 1200 kHz and 1220 kHz for these measurements. Curiously, I got much lower narrow dynamic range measurements for my R–390A than reported by Sherwood. Perhaps my home made hybrid coupler does not have the high port isolation required for narrow dynamic range measurements.

Next, I removed the band 1 mod from one J4 (the other J4 did not have the band 1 mod) and restored R149 to the original 680 ohm half watt resistor in both J4's. The measured resistances of the resistors I used were 705 and 715 ohms, and the measured AGC bias was about –1.80 VDC in both cases. After *carefully* realigning band 1 of the J4 which had previously been insensitive on band 1 (see my comments on band 1 alignment below), I measured the sensitivity of both J4's as better than 3 microvolts for a 10 db S-meter indication. This was quite incouraging, and not at all what I expected. Apparently I was not careful enough the first time I aligned band 1 in the "insensitive" J4. Several hours of nighttime listening on the BCB with an 85 foot inverted L antenna revealed no cross modulation, and sensitivity was excellent, with man-made (power line, et al.) noise clearly audible between beacons below 530 kHz and above 1600 kHz. Comparison listening tests with the J4's and a R–390A showed virtually no difference in sensitivity among the three. So it is a mystery to me why the J4 has a reputation for being insensitive on the BCB. Perhaps others made the same mistake I made and did not align band 1 as well as possible, or perhaps they did not use an antenna which is suitable for J4's. The manual states that the J4 is designed for use with a single wire or whip antenna, and that the J4 has a high impedance antenna input. J4's do give lower S-meter readings on band 1

as compared to band 2 on the same same signals where comparisons can be made in the frequency range overlap for bands 1 and 2. But this merely suggests that J4's are more sensitive than necessary on band 2.

To confirm what my ears already told me, I remeasured the dynamic ranges of both J4's on band 1. The results were gratifying. A two tone dynamic range test at 1200 kHz with test signals spaced 20 kHz apart gave 80 db for one J4 and 83 db for the other. Most of the dynamic range reduction appears to have been caused by the R149 mod, but I would still recommend against the band 1 mod because it is simply not necessary or desirable. On band 1 a J4 is triple conversion, with tuned IF's of 10.5–11.5 mHz and 2.5–3.5 mHz which track the front end. There are, consequently, two mixers for band 1. Collins was apparently very careful to distribute the J4 gain so that the mixers would receive the lowest possible signal levels (maximum dynamic range) while maintaining adequate sensitivity.

Therefore, I would like to retract my previous words. Collins did not do a terrible thing and desensitize band 1. I did a stupid thing and reduced band 1 dynamic ranges of my J4's by more than 10 db with the band 1 mod and R149 mods. Of course, Orr and other hams who did the R149 mod reduced the dynamic ranges of their 51J's. Fortunately, it is relatively simple to undo the band 1 and R149 mods. These mods do improve 51J sensitivity. But in my opinion there is no need to improve the sensitivity of 51J's provided they are aligned *carefully*, and the price you pay for improved sensitivity is significantly reduced dynamic range, especially on band 1 (the BCB). The price seems unacceptable to me. (Dallas Lankford)

SP–600 MOD: Being a Hammarlund SP–600 fan I made an interesting conversion, and it worked beautifully. I had the following to work with: one completely restored and working SP–600 VLF receiver, 10 kHz – 540 kHz (a very rare model), and three SP–600 junkers. I was determined not to permanently change or destroy the rare VLF model. Because I live in a very noisy location, the VLF model was almost useless to me except as a collectors item.

A perusal of both schematics showed the VLF and regular models to be almost identical from the antenna to the first mixer, except for the individual antenna, two RF, and VFO coil assemblies for each band. The main ganged tuning capacitor is identical physically and electrically in both models. All I had to do was change all the individual ceramic mounted coil and trimmer assebblies. Anyone familiar with the SP–600 will know how that is accomplished, so I won't bother to describe the procedure. The I did the usual alignment, including setting the VFO for the first IF of 705 kHz. [? Ed.] That is all it took. From the first mixer on the receiver operated like normal.

So that you Hollow State subscribers don't think I am a heretic let me hasten to add that I also love my R–390A, and also have a R–390 and R–392 restored and sitting in the racks.

While I have this opportunity let me extend an invitation to any Hollow State subscriber who would like to trade or talk hollow state equipment to give me a call (714) 827-4282. (John Browning, Buena Park, CA) [On the conversion of your SP–600 VLF to a regular SP–600 did you also change the dials? I would presume you did. In any case, it is interesting that a SP–600 VLF can be converted to a SP–600 so easily, and without permanent damage to the SP–600 VLF. I would assume the reverse conversion is equally easy. So if someone has a junker SP–600 VLF with a complete set of ceramic coil and trimmer assemblies and a good dial, it would appear that all they need is a nice working SP–600 and a few hours of their time to produce a nice working SP–600 VLF. Ed.]

SP–600 REBUILT: I picked up my SP–600 last year (1987) for $100 (Canadian). It worked fairly well, but did not compare with my R–2000 or R–390A. Then one evening a black tubular (BT) inside T5 expired. Thinking that this was the beginning of a bad trend, and keeping in mind previous comments and discussions about the BT's in *HSN* 16 and 19, I set out to replace all of the BT's and electrolytics. The project took 50 hours of labor, including alignment time, and 22 feet of Chem-Wick Lite 0.15". I used Mallory PVC type

600 for the 0.01's and 0.02's, and replaced the electrolytics with modern counterparts. The SP–600 is now very impressive. Dial accuracy is plus or minus the pointer width on all bands except the top band near 54 mHz. Anything heard on the R–390A or NRD–525 can also be heard on the SP–600, except were selectivity under the *toughest* conditions is a factor. (Shaun Merrigan)

HC–10 COMMENTS: In early 1988 I obtained a Hammarlund HC–10 Converter through the Ham Trader Yellow Sheets for $75. The unit was in excellent condition, and came with the original manual. The previous owner had thoughtfully added a front panel headphone jack. After using the HC–10 for most of the spring and summer, primarily with my R–390A, I noticed distortion in the upper sideband AM mode, no matter how carefully I tuned the R–390A. In addition, I had to fiddle with the vernier fine tuning and BFO to get good SSB reception. I finally decided to align the HC–10 in accordance with the manual instructions. The alignment is very simple, but requires a 60 kHz source. I used my trusty URM–25F, a digital frequency counter, and a digital multimeter. [A frequency counter is not required. The 25F could be set to 60 kHz by tuning the R–390A to 540 kHz and adjusting the 25F for zero beat with the R–390A BFO. Ed.] The procedure took a couple of hours, including one hour for HC–10 warmup. There were six 60 kHz IF transformers and a BFO coil to be aligned. The HC–10 input circuit must also be tuned to the IF center frequency the receiver it is to be used with. After I completed the alignment, the USB AM distortion was gone, and I could use the HC–10 for SSB without having to fiddle with the vernier fine tuning and BFO. I now have two HC–10's, one for my R–390A and one for my recapacitored SP–600. I find the HC–10 adds a great amount of flexibility to both receivers in terms of sideband selection, AVC times, slot filter, and product detector in SSB mode. The HC–10 is a very worthwhile and relatively inexpensive accessory. If anyone would like high quality photocopies from an original manual, just drop me a line. (Shaun Merrigan, 14203 - 72 Street, Edmonton, Alberta, Canada, T5C 0R4)

USING A HC–10 WITH A 51J: The first time I used a HC–10 with a J4 the resulting SSB performance was disappointing. SSB signal quality could at best be described as poor, and at worst unacceptable. I disconnected the HC–10, put it away, and did not think about it again until recently. One evening as I was reading the J4 manual I noticed that the J4 IF output impedance was specified (as 50 ohms), but the IF output level was not specified. So I borrowed a scope and measured it. The IF output measured a whopping 12 volts peak-to-peak! No wonder the HC–10 sounded terrible when connected to my J4. It was being overloaded. Using the scope I determined that a 2700 ohm half watt resistor in series with the HC–10 input dropped the voltage to an acceptable level, namely 200 millivolts at the input of the HC–10. With the dropping resistor in place the J4 and HC–10 combination was excellent for SSB and CW, not to mention AM. The same mod would probably be required for any 51J series receiver, including the R–388, although I have not tried it. For those of you who are not familiar with the HC–10, it is essentially the IF strip of a Hammarlund HQ–180, and includes a notch filter, bandwidths of 6, 4, 3, 2, 1, and 0.5 kHz, three AGC release times, IF vernier fine tuning, and a product detector. I wanted to use my HC–10 with either a J4 or R–390A, so I added a second IF input directly below the original IF input on the chassis rear. I used a fancy ceramic RCA jack almost identical in design to the original which I bought from RF Connection. A previous owner had already drilled the required holes, so I merely bolted the second jack in place and ran a 2700 ohm resistor from the new jack to the old jack. This provides low level (original) and high level (new) IF inputs. Of course, I still have to change the IF input frequency and realign the slot filter when switching between a J4 (500 kHz IF) and R–390A (455 kHz IF). (Dallas Lankford)

USING A HC–10 WITH A SP–600: A HC–10 seems to work well with a SP–600. But after Dallas had problems using a HC–10 with a 51J4 because of high IF output voltage, he asked me to determine the SP–600 IF output voltage. The SP–600 IF output voltage is

not specified in the manual. Using a URM-25F and a scope the SP-600 IF output voltage was measured and found to be 3.5 volts peak-to-peak maximum. I did not determine a suitable value for a dropping resistor. [The 2700 ohm value I used to reduce the 51J4 IF level would probably be suitable. Ed.] The SPC-10 converter was made specifically for the SP-600, so it probably has a higher IF input voltage range. (Shaun Merrigan)

MIL-COM EXCHANGE ELECTRONICS: P.O. Box 982, Orange Park, FL 32067-0982. Their catalog is free. They sell some of the same kinds of military surplus gear as Fair Radio, but not as many components. They also list several hundred technical manuals, such as the R-390A operator's manual TM 11-5820-358-10 for $9 (which Gerald Murphy asked about in a previous *HSN*), and schematics. (Shaun Merrigan)

51J AND SP-600 MODS: If your read my contribution "51J4 Mods ?" earlier in this issue, or were one of the unfortunate persons who rushed out and bought a large number of 3HTF4's (see *HSN* **19**), you may wonder why we continue to publish untested mods. Sometimes I do too. But we do get requests for mods, and you can usually undo a mod if it is not satisfactory. So in that spirit, here are some articles from ham radio publications which you might find interesting. "The single tube product detector," by Commander Paul H. Lee, W3JHR, *CQ* (Apr. 1961), pages 50-51, 118-119, describes a 6BE6 product detector, a crystal controlled BFO, and AGC mod for the 51J2 which would be applicable to all 51J receivers and the R-388. "A product detector for military receivers," by Joe H. Owings, K0AHD, *CQ* (Mar. 1967), pages 68-68, 102, describes a 1N67 diode product detector and AGC mods, including installation instructions, for a SP-600 or R-388. "Further improvements for the 51J," by Commander Paul H. Lee, W3JHR, *CQ* (Apr. 1968), pages 68-70, 118, describes a crystal lattice bandpass filter mod using FT-241-A crystals and a 6DJ8 dual triode first mixer mod for improved sensitivity. [Does this sound familiar? Ed.] "More on updated improvements for the 51J receivers," by Wilfred M. Scherrer, W2AEF, *CQ* (Dec. 1968), pages 64-69, 116, describes a variation of the W3JHR product detector (see above), a different AGC mod, a VFO regulated heater supply, a 6AL5 SSB type noise limiter, a 500 kHz IF output mod for the 51J2, and a panel bearing mod for the KCS tuning shaft. "Modifying the Collins 51J receiver for SSB reception," by William I. Orr, W6SAI, *HR* (Feb. 1978), pages 68-70, 118, describes the R149 mod which improves sensitivity (but decreases dynamic range as I learned to my dismay), a variation of the W3JHR product detector (see above), and a different AGC mod. All of these articles are concerned with SSB (or CW) mods, and mainly involve adding a product detector and changing the AGC circuit. I have not tried tried any of the product detectors described in the articles above, but I did spend considerable time prototyping and testing some of the AGC mods. The results were uniformly disappointing because all of the AGC mods changed the AGC line voltage and introduced severe audio distortion on AM signals. The AGC mods might be fine for SSB when used with a product detector, but they ruin AM audio quality. In my opinion you are better off adding an outboard converter like the HC-10 because the only mod required is a dropping resistor to reduce the IF signal level to an acceptable value for the HC-10. (Dallas Lankford)

$500 SOLID STATE RX OUTPERFORMS R-390A BY A MILE: That's what the *Pop-Comm* editor said in the December 1988 issue. What kind of receiver is it, and where do I buy it? The only solid state RXes I know of for under $500 are portables. I have a top rated DX-400 (essentially a Uniden CR-2021). With stock 10 kHz wide and 6 kHz narrow bandwidth filters the DX-400 is barely adequate for casual listening on the SW bands. Friends of mine who own Sony 2010's complain about overloading on the BCB and the unsuitability of the stock filters. Even with filter mods neither will come close to the performance of a R-390A. To come close to the performance of a R-390A you will need a highly modified R-71A which retails for about $1100 or a NRD-525 with stock filters replaced by Collins F455FD mechanical filters which retails for about $1600. (Dallas Lankford)

THE HOLLOW STATE NEWSLETTER

FALL 1989 No. 23

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PUBLISHER'S AND EDITOR'S CORNER

We apologize for there being only three issues this year, and thank you for your patience. This time the delay (in issue 22) was caused by Chris. So we each have one delay. Again, let me ask you all to remember that we receive no pay and make no profit on the newsletter, and that our normal jobs and activities sometimes take precedence.

SHORT CONTRIBUTIONS

$30 RADIO SHACK PORTABLE OUTPERFORMS R–390: In the Frequency Deviations column, "Ray Cole's earthquake research progress report," *DX News* **56**, 25 (Apr. 24, 1989), page 35, Ray said, "I have four antennas to try, and on the BCB band the TRF beats my National NC–173 by a lot, and the R–390 lags a very sad third." (Anonymous) [Maybe he didn't have the R–390 turned on. If anyone wants to trade an R–390 for an NC–173, let me know. Ed.]

WANTED: Power supply PP-629/URR and special purpose electrical cable assembly CX-2083/U for my R-391. (Richard Parker, KB2OMD, 21 Blue Grass Dr., Trenton, NJ 08638)

WANTED: CV-591, CV-1758, or CV-157 by TMC. Hammarlund HC-10 also considered. (George Ross, 127 Cebtre St. West, Richmond Hill, Ontario L4C 3P6, Canada, (416) 884-4116) [Fair Radio usually has some of the CV series sideband converters. Ed.]

3TF7 MOD: After consulting with Dallas about the various ways of eliminating the 3TF7, I settled on Irving Megeff's mod in *HSN* 17, Fall 1987, pp 5-6. I farmed the job out to a chap up here who specializes in amateur radio repair. While testing the mod, he noticed that the resistor ran hot (it is underneath the chassis). So he used three 15 ohm 10 watt resistors in series instead of a single 40 ohm 5 watt resistor. This runs quite cool. The mod works like a charm. (George Ross) [Thanks for the feedback. This kind of information helps us all. Ed.]

26Z5W TUBES FOR SALE: Up to 20 new 26Z5W's for $3.60 each plus shipping. Darcell Electronics, 4910 Santa Anita Ave., El Monte, CA 91732, (818) 443-5801. They also have 73 used, checked 26Z5W's at the same price. (Joe Bunyard)

R-388 AND 51J RF AMP TUBE SUB: The RF amplifier, a 6AK5, can be replaced by a 6BZ6 for approximately 10 dB increase in gain as seen on the S-meter by disconnecting the antenna and switching on the 100 KHz calibrator. (Walter Hann) [I checked the mod using a URM-25D signal generator and a 51J-4. The URM-25D was set to 2.5, 25, 250, and 2500 microvolts. Corresponding S-meter readings with a 6AK5 were 10, 40, 65, and 85 dB. Corresponding readings with a 6BZ6 were 8, 32, 56, and 90 dB. You can see that on the very strongest signals the 6BZ6 gives higher readings, on mid range signals the 6BZ6 gives lower readings, and on weak signals the 6BZ6 gives about the same readings as a 6AK5. I did not measure the dynamic ranges, but the higher 6BZ6 S-meter readings on strong signals suggests that the 6BZ6 would degrade the strong signal handling performance of an R-388 or 51J series receiver. Also, the 6BZ6 pins the S-meter on some strong signals. I would recommend against this sub unless your 6AK5 dies and a 6BZ6 is all you have. Ed.]

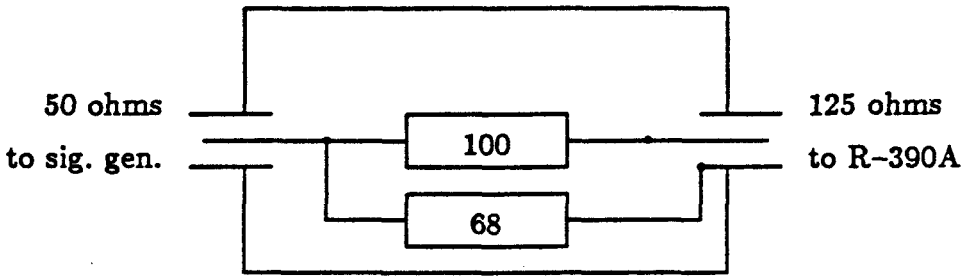
TUBE SHIELDS MOD: For better heat removal, I have all of my tube shields painted black, inside and outside. This is easy to do with black spray paint. (Walter Hann) [Some tube shields in Collins equipment were originally painted black, and some were anodized a dark blue. Ed.]

RF PROBE: A good RF probe (e.g., for making measurements on the RF subchassis of an R-390A) is the PK-3A, available form Heathkit, Benton Harbor, MI 49022. It can be used with any DC voltmeter with an input impedance of 10 megohms. RF measurements from 1 KHz up to 100 MHz, up to 90 volts, with an accuracy of 10% can be made with the probe. (Walter Hann)

R-388A: Did you know that there was an R-388A, a military version of the 51J-4 (with mechanical filters)? I didn't until Wally Chambers and Walter Hann told me. Wally sent a page from MIL-HDBK-161 which said, "Radio Receiver R-388A/URR, procured by the USN, is identical to the R-388/URR, except that it uses mechanical filters and nonmagnetic side panels." Has anyone ever seen one of these? (Ed.)

DA-121/U DUMMY LOAD: The DA-121/U dummy load was used by the military to measure the sensitivity of an R-390A. It consists of a small RF tight metal enclosure with one BNC female connector at each end. A 100 ohm half watt resistor is connected in series with the center conductors of the BNC connectors. A 68 ohm half watt resistor is connected from one of the BNC center conductors to ground. The BNC connector with the 68 ohm resistor to ground is the signal input port (which is connected to a signal generator). The other BNC connector is the signal output port (which is connected to

the R–390A). (Walter Hann) [Thanks for the information. The DA-121/U dummy load appears to be an impedance matching device which matches 50 ohms to 125 ohms. I fabricated one and have used it to make precise sensitivity measurements on R–390A's. It works great. Below is a cut-away line drawing. Ed.]



$1700 R–390A: An advertisement by EAC Industries, Inc. in the Oct. 1968 issue of *73 Magazine* listed brand new, 1968 production R–390A's for $1700, with a few new, but shelf-worn, units available at lower prices. Each included original packing, two instruction books, and a complete set of running spares. These probably were the end of a military contract, and may not have met mil specs. (Wally Chambers)

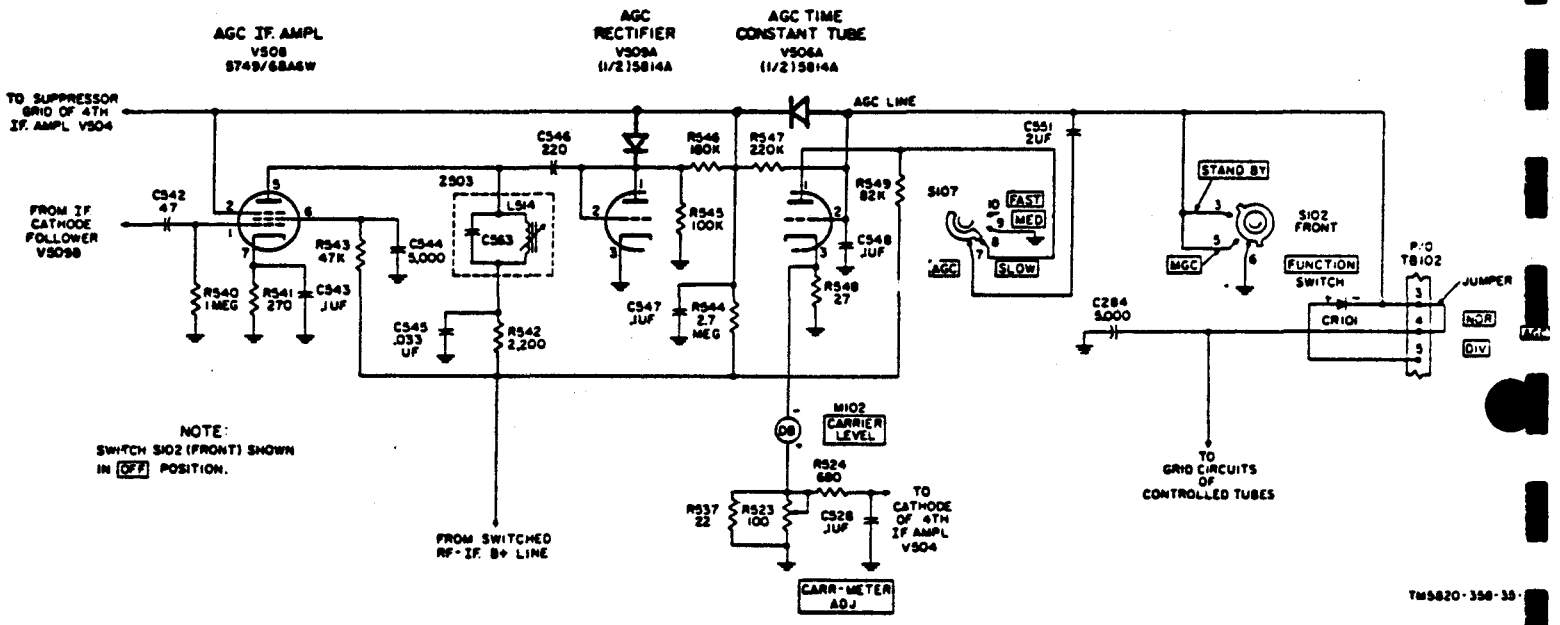
R–390A PTO ADVENTURES: One thing I noticed about my R–390A some months after its acquisition was that the PTO end points were so far out of alignment that I could not calibrate the KCS dial throughout the tuning range. I decided to take what I thought was the easy way out and order another PTO from Fair Radio. A few days after the arrival of the new PTO, I finally had an evening to spend on the replacement. But when I tried to loosen the spline set screw on the Oldham coupler, I found that someone had been there before me and stripped the splines. I tried everything – a larger spline wrench, hex wrenches, even super gluing a hex wrench to the screw. Nothing worked. Finally, a friend suggested I get a needle file, file a notch in the socket head, and remove it with a blade screwdriver. If you've never seen a needle file, they are similar to an aluminum nail file, but smaller and thicker. They are miniature files, and usually come in a set with various shapes and sizes. Once you see a set, you will recognize them as tools you needed, but didn't know you needed. Anyway, I filed and filed, and at last made enough of a notch that I could turn the screw with a blade screwdriver. When I got it out, I found that the threads were stripped at one point, which had caused the problem. I replaced it with a normal slot head screw, not having any spare spline screws. Removal of the old PTO and installation of the new PTO were routine with the help of Dallas' instruction on PTO alignment in *HSN* **6**. Thanks Dallas. If anyone has similar problems, I'd be happy to go into more details any time. (Joe Reda, 4237 Hamilton Ave. #B. San Jose, CA 95130) [More good feedback. And I want a set of needle files. Ed.]

MANUALS: In a previous issue of *HSN* I mentioned Mil-Com Exchange Electronics, P.O. Box 982, Orange Park, FL 32067-0982, as a potential source of manuals. I bought the R–390A operating manual, TM 11-5820-358-10 ($9.00) and the SP–600 manual, actually three manuals in one ($12.75). Both have excellent print and picture quality. They were punched for a standard three ring binder, and had heavy (cord) stock for the front and back covers. The SP–600 had folded 11 by 17 inch sheets for the oversized pages, not the patchwork pages you often get. I plan to order the R–389 maintenance manual from them. (Shaun Merrigan) [Thanks for the follow up. I wonder if they reproduce the two huge schematic pages of the R–390A depot maintenance manual TM 11-5820- 358-35 without cutting and pasting. Also, I noticed they sell the NAVSHIPS 93053 series of R–390A manuals. After writing this, I ordered their SP–600 and R–388 manuals. They are excellent reproductions.

However, I was somewhat disappointed with their SP–600 manual. It contains only one schematic. But there are several production runs of SP–600's (military R–274), and all are wired differently. I have been told that he best manual for SP–600's is the Army manual TM 11-851. It contains all the different schematics, by serial number. Ed.]

MORE MANUALS: The National Archives, Washington, D.C. 20408 is a source for some manuals and technical bulletins which cannot be found elsewhere. I have obtained copies of TB 11-6625-697-35 (for calibrating the URM-25 series signal generators) and TM 11-854 (the R–388 maintenance manual) from them. (Walter Hann) I purchased a reprint of the R–389 manual from The National Archives. Their prices are, however, rather steep, generally 35 cents per page, with postage extra. The reprint I received did *not* contain a complete circuit diagram. (Terry Robinson)

R–390A AGC MODS: The R–390A maintenance manual TM 11-5820-358-35 goes into considerable detail about the AGC circuit (pages 32 – 34), and includes the following simplified schematic.



The AGC's of many R–390A's, including mine, have been modified using the so-called Cornelius AGC mod which was described in *HSN* **1** and **10**. The mod consists of removing R545, replacing R546 by a 1N34A, 1N60, 1N270, 1N914, or 1N4158 diode with cathode connected to pin 1 of V509A, and replacing of R547 by a 10K ohm half watt resistor. The mod increases the AGC line voltage, which reduces the signal level at the diode detector V506B and, consequently, improves SSB reception quality.

Recently I discovered a modification which is easier to do and increases the AGC release times for FAST and MED. My mod does not require removing any components. You merely add two diodes as shown on the schematic above. I used 1N270 (actually ECG 109) diodes, but any of the diodes mentioned above could be used. Measured attack times for my mod are 0.001, 0.01, and 0.2 seconds, and release times are 0.01, 0.12, and 2.5 seconds for FAST, MED, and SLOW respectively. The times vary somewhat from one IF subchassis to another. The attack times are virtually the same as for the Cornelius mod. The FAST and MED release times are about twice as long as for the Cornelius mod, which is a modest improvement for SSB using the MED AGC position.

The attack and release times are not optimal for SSB; 0.002 seconds attack and 1 second release are often recommended. However, the MED position does provide acceptable SSB reception, and is a big improvement over an unmodified IF subchassis. (Dallas Lankford)

R-388 NOTES: Recently I obtained a very nice R-388 theough the Yellow Sheets. It seemed fairly well aligned, all controls worked fine, and there were no surprises. Dallas' review of the 51J series receivers from *HSN* 20 was a big help in evaluating my "new" R-388. Regarding stability, I would certainly agree that the R-388 compared favorably with my R-390A. There is some backlash in the KCS tuning dial of my R-388, like Dallas observed in the 51J series receivers. I have eliminated the backlash by inserting two small pieces of rubber, one between each end piece and center piece of the Oldham coupler. The rubber pieces are small enough to permit the center piece to mate with the end pieces, but large enough to take up the slack. And they produce very little pressure, so the PTO bearings will not be damaged. [Nice idea. Ed.] I was lucky in that the MCS dial drum decal in my R-388 had only two small spots flaked off. To prevent further flaking, I gently cleaned the entire drum with a dilute (0.1%) sodium hydrochloride solution, and gave it three coats of Flecto Varathane liquid plastic, clear gloss #90. No deterioriation of the numbering was observed. In fact the numbers are easier to read because of the glossy drum surface. In my experience, the sodium hydrochloride solution does not hurt old plastics, and removes the yellow tinge so often found on older dial indicators and plastic parts. To give the knobs a like new appearance after cleaning, I used Armor All protectant. For smooth nonporus surfaces, Armor All Ultra Plate works very well. Finally, with regard to SSB, I attached a Central Electronics Sideband Slicer, Model B to my R-388 and got excellent results. (Shaun Merrigan)

AN/FRR-59A: I have been going through the NAVSHIPS 94715 manual for the AN/FRR-59A, which I obtained from Mil-Com in FL, and I have never seen tube circuits like these before. It is apparent that the 59A was a tube precursor of current solid state digital receivers as it contained frequency synthesis, drift cancelling loops, balanced ring modulators, 100 Hz mechanical digital readout, 64 (!!) tubes, and so on. I would be interested to know if any of our members use or have used the 59A. (Shaun Merrigan)

MORE COLLINS 51J TECHNICAL NOTES: The following is taken from my 6 page article article, "More Collins 51J Technical Notes," which is available for a $1 bill and a SASE with 65 cents in stamps.

Apparently I lead a charmed life because both of my J4's have nearly perfect PTO's with end points off by no more than 1/2 kHz, linearity within 1/2 kHz at each 100 kHz point from end to end, and little warm up drift. In addition, the end point adjustment shaft in both PTO's, though stiff, can be turned with the home made alignment tools I described in my first technical notes article.

The PTO in a virtually unrepairable J4 which was recently brought to me for repair showed me how lucky I had been. The end points were about 15 kHz off, and when I tried to do an end point adjustment I discovered that the end point adjustment shaft slot had been broken by a previous owner. Since I had a bad PTO with a good end point adjustment coil from a junker R-388 I decided to try to repair the otherwise good PTO. However, in the process of switching end point adjustment coils I noticed that the good coil would not screw in. Something appeared to be stopping it. I backed the shaft out all the way and saw the problem. There was a shaft lock "nut," a small threaded circular piece of metal with two minute slots in it. Then I remembered the Collins PTO end point adjustment tool which is pictured in the J4 manual, and suddenly the peculiarity of that tool (actually two tools) made sense. One tool is like a small screw driver, but with a knurled end rather than a handle. The other tool is hollow, with two thin "blades" on the rim of the hollow tube. The screw driver tool is inserted into the hollow tool and the two are used together to unlock and lock the end point adjustment shaft lock nut, and the hollow tool is used to prevent the lock nut from locking while the shaft is screwed in. Apparently some end point adjustment shafts can be screwed in with the lock nut "locked" (like those in my two J4's) and some cannot (like the one in the J4 with the broken slot). A J4 with an end point adjustment shaft which cannot be screwed in with the shaft locked can still be adjusted by backing the shaft out all the way to access the lock nut, backing

the lock nut out all the way, adjusting the end point, backing the shaft out all the way while counting turns, and then by trial and error setting the lock nut at just the right position so that the shaft can be screwed back in the correct number of turns. Good luck! After replacing the broken end point adjustment coil, the end points were still about 10 kHz too wide with the end point adjustment shaft screwed all the way in. Oh well, I still had a brand new (er, unused) J4 PTO which I had been saving in reserve. But to make a long story short it was bad too, with end points 4 kHz too wide after the end point adjustment shaft was screwed in all the way.

Are there two kinds of 51J series PTO's, those with end point spread rates about 1.5 kHz per year, and those with very slow spread rates? If I knew the answer, I would tell you. My best guess is that there are, but I have not had my two J4's long enough to know. If there are, then there are two inherent categories of 51J series and R-388 receivers, those with "good" PTO's and those with "bad" PTO's. In my opinion a substantial amount of the value of a 51J series receiver is directly proportional to the quality of the PTO. For example, end point spreading of a bad PTO will eventually desensitize the low bands, especially band 1, and in any case accurate frequency determination is one of the primary desirable features of 51J series receivers. Is there any way to tell such 51J series receivers apart without checking the end point adjustment range? I can't think of any. You are probably in the hands of fate when you buy a 51J series receiver. (Dallas Lankford)

SP-600 REPAIRS: My SP-600 is back on line after losing reception on the three high bands (above 7.4 MHz). The problem was in the 2nd (3.5 MHz) conversion oscillator and mixer, but it was not easy to pinpoint. I tried the usual fix of new (unused) tubes with negative results. Using the SP-600 manual, I then spent several frustrating hours tracing an *apparent* low screen voltage mixer tube problem all the way back to the mains transformer secondary. Then I remembered Dallas' remark about the HQ-180A manual tube socket voltage chart being incorrect in places. Assuming the same for the SP-600 manual, I proceeded to trace the problem to the 3.5 MHz crystal. This is where things got interesting. Upon application of heat (a soldering iron tip, for example, which is how I discovered it), the oscillator would work fine until it cooled down. I decided to try to remove and clean the crystal unit, as I knew I could not get a new one easily. To my surprise, I found that the pressure spring and holder assembly were covered with a film of light oil, rather like the kind left behind by the Chemtronics cleaner and lubricant I had used on the selectivity switch. The seal on the crystal assembly, such as it might have been, had gone years ago. I completely disassembled the crystal unit right down to the piece of quartz and cleaned everything with isopropyl alcohol. After reassemble and installation, the oscillator and receiver worked fine. Apparently the oil film had formed an electrical or mechanical barrier which prevented the crystal from oscillating. The moral of this story is: Watch where you spray the cleaner and lubricant! (Shaun Merrigan) [Great story, Shaun. Ed.]

FOR SALE: Signal generators, checked: URM-25F $50, H. P. 606A $85, H. P. 608D $100; distortion analyzers, as is: H. P. 330D $50; oscillloscopes, checked: USM-281A $300, USM-281C $400. No manuals are included. Photocopies of manuals probably can be obtained from Fair Radio. Lid accessories are not included with the URM-25Fs, but are available; include SASE for a price quote. (Joe Bunyard, 1601 Lexington St., Waco, TX 76711)

51J AND R-388 FLAKING MCS DIAL DECAL: I have been working on another solution for the flaking MCS dial decal, namely making new decals. I have the camera ready masters (for a two color copy) which I produced with my typesetting software. What I don't have is the name and address of a company which makes the old fashioned, water transfer decals. Can anyone help? If I had a dial drum to work from, I could also make camera ready masters for the 75A series ham band only receivers. (Dallas Lankford)

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Publisher's Corner

We're back! Please excuse the long delay. This special double issue, Nos. 24 & 25, was to have been the final issue. Camera ready copy was sent to Chris in May 1990, and Chris was to have printed and mailed this special final double issue, and refunded outstanding subscriptions. But it never happened. After many delays, the details of which need not concern us here, our new publisher, Ralph Sanserino (address above) volunteered to assume Chris' duties and I let myself be talked into continuing as editor. We all owe Chris a BIG THANK YOU for his years of service as publisher of The Hollow State Newsletter.

You may observe the peculiar mix of typesetting and IBM typewriter fonts. This is because I am temporarily without a computer and laser printer. But never fear, the technical quality of the newsletter will remain first rate. Looking ahead, there are a number of articles that I know you will not want to miss. For example, you may recall in HSN #23 there was an improved version of Cornelius' AGC mod for R-390As. But you haven't seen anything yet! Wait for my write up of a true fast attack, slow release AGC mod for the R-390A which greatly improves SSB and CW performance without degrading the R-390A's already outstanding AM performance. It will appear shortly in HSN #26 or #27. Also ready to print are articles on a great fast attack, slow release AGC for the 51J-4, an outstanding product detector for the 51J-4, a mod which fixes the 51J-4 band 1 insensitivity without degrading dynamic range, and an HQ-180(A) mod which eliminates overshoot and slows down the release times for much improved reception quality of fading SW broadcasts and MW graveyard signals.

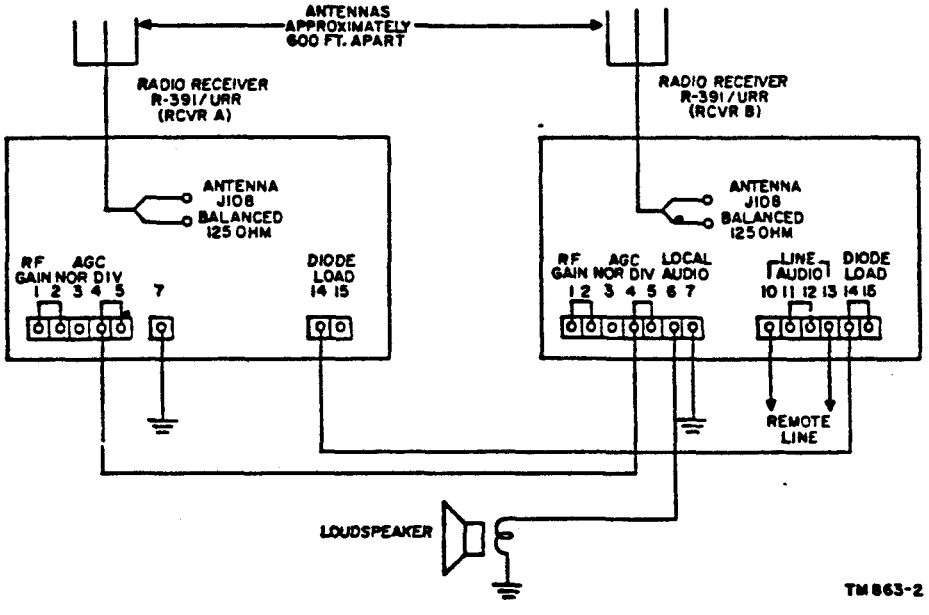
One problem that Ralph and I face is a serious shortage of cash. Most of the current HSN assets are tied up in back issues. Hopefully we will eventually convert these back issues into operating capital, but that does not solve our immediate problem. You can help by sending Ralph (address above) a one dollar bill. Please remember that neither Ralph nor I receive any pay or make any profit from HSN. Your help in this regard will be greatly appreciated.

In closing, let me mention The Collins Owners Club, C/O Bob Ralph, 4 Leam Crescent, Solihull, West Midlands, B92 8PD, England. They need someone to help in obtaining spare parts from the USA. Any volunteers?

SHORT CONTRIBUTIONS

Q-MULTIPLIER AND SB–620 FOR THE R–390A: Connecting a Q-multiplier and SB-620 (Heathkit Scanalyzer) to an R–390A is not entirely trivial. Previously I had connected a Q-multiplier to the plate of the 1st IF tube. This worked, but seemed to produce a degraded signal. Apparently there was a detuning action between the Q-multiplier and the IF strip. Since the R–390A IF transformers are stagger tuned, I decided not to mess with them. The best approach is to use a 7 pin miniature tube test socket to obtain a solder lug at pin 1 of the 455 KHz mixer V204. I used a full size test socket, so I removed the RF deck cover plate. [Many test sockets can be disassembled and modified to a shorter length so that the cover plate can be retained. Or you can remove the RF deck and add an appropriate connector beside V204. Ed.] After experimenting with different values of capacitance recommended in the Scanalyzer manual, I found that 7 pF gave the best overall results. I am currently using two Heathkit Q-multipliers, one as a notch, and one as a peak, together with the SB–620. I find the combination useful in some difficult listening situations. The SB–620 helps adjust the null and peak. (Wayne Heinen, 4131 South Andes Way, Aurora, CO 80013) [Wayne, I am sorry that I did not understand from your description how you connected this most interesting combination of accessories. I hope you don't mind my including your address so that interested individuals can contact you for more information. Readers, please include an SASE if you write Wayne. Ed.]

R–390A SPACE DIVERSITY RECEPTION: In *HSN* **3** there was a block diagram which showed two R–390As connected for space diversity reception, but no details where given. Recently I stumbled across the following from TM-863. (Dallas Lankford)



TUBE FILAMENT VOLTAGE: In *HSN* **19** Dallas commented about the undesirability of operating tubes at tube filament voltages much beyond the maximum rating. In *Glass Audio*, Feb. 1989, an article "Extending Tube Life," by Charles King, provides detailed information about this issue. Here are some of the important points reported in that article. There is considerable published misinformation on the topic of tube life and performance versus tube filament voltage. For example, a graph in Tremaine's *Audio Cyclopedia* (2nd Ed., p. 472, Fig. 11-71) shows that tubes will fail prematurely if the voltage is either too

high or too low. However, King remarked that he had found data published by GE (King gave no reference) which conflicts with Tremaine's position. The GE data reported by King included the following interesting items. "When filaments intended for operation at 6.3 V were driven at 7.56 V, 80% failed during the first 5,000 hours. When a similar number of tubes were operated at the rated voltage, 75% continued to work at the 5,000 hour point. When tubes were operated at only 5.04 V, virtually *all* lasted through the 5,000 hour point. Transconductance was also measured, and a significant reduction was noted when the voltage dropped from 6.3 V to 5.04 V, but the difference lasted for only about 1,200 hours. Throughout the test, the transconductance of the tubes operating at 5.04 V remained relatively constant, while the other tubes varied considerably." [Inspection of the graphs in King's article revealed that the transconductance of tubes operated at the rated filament voltage or higher declined quickly until the 1,200 hour point (where their transconductance became equal to the tubes operated at 5.04 V) and then declined slower thereafter (while the tubes operated at 5.04 V continued to maintain relatively constant transconductance). Ed.] King also ran extensive tests to determine the optimal value of tube filament voltage for audio equipment. He concluded that tubes should be operated at 5% less than their rated voltage. For tubes with 6.3 V filaments, this would be 5.985 VAC. (John Peterson)

L TYPE MULTIPLE SPLINE BRISTOL WRENCHES: As of November 1989, the Snap-On Tool company carried a complete set of L type spline wrenches. The following table summarizes their product line, and includes useful information for identifying spline wrench types. (Walter Hann)

Screw #	Flutes	Outside Dia.	Snap-On #	1989 Price
2	4	0.033 inches	MS2	$1.00
3	4	0.048 inches	MS3	$1.00
4	6	0.060 inches	MS4	$1.00
5	4	0.069 inches	MS5	$1.00
6	4	0.076 inches	MS6	$1.00
7	6	0.072 inches	MS7	$1.00
8	6	0.096 inches	MS8	$1.00
10	6	0.110 inches	MS10	$1.00
16	6	0.144 inches	MS16	$1.00
20	6	0.183 inches	MS20	$1.25
24	6	0.216 inches	MS24	$1.65
28	6	0.251 inches	MS28	$2.50
32	6	0.291 inches	MS32	$3.75
40	6	0.372 inches	MS40	$5.50
48	6	0.454 inches	MS48	$9.95

R-389, R-390, R-390A, R-391 RELAY PROBLEMS: Some time ago, Richard Parker and I corresponded about problems he was having with the relays in his R-389 and R-391. In cooperation with professors in the Electrical Engineering Department at Louisiana Tech University, I assisted Richard with a solution. We had planned to write a detailed description of the problem and the fix, but due to space limitation in this final issue of *HSN*, and because the problem and cure apply the the R-390 and R-390A as well, I have decided to write a generic description of the problem and the cure, and ask Richard to assist needy individuals with specific questions about the R-389 and R-391. His address is 21 Blue Grass Drive, Trenton, NJ 08638. Be sure to include an SASE if you write him. The relays in R-3XX receivers are operated from a DC voltage generated by a copper oxide or metalic rectifier. My EE friends tell me that metalic rectifiers are notorious for slowly failing, which means that we all can expect problems with the relays in R-3XX receivers

as time goes by. When the voltage of a failing rectifier drops, the relays may fail to operate in STAND BY and CAL, and the BREAK IN relays may fail to operate. The solution is to replace the rectifier (CR801 in an R-391, CR102 in an R-390A) with a full wave silicon bridge rectifier. At my suggestion, Richard used a 4 amp, 50 PIV bridge, Radio Shack # 276-1146. He also used a 25 ohm, 25 watt dropping resistor for his R-389 and R-391. The dropping resistor was used because a metalic rectifier puts out less voltage than a silicon bridge. I don't recall How Richard arrived at the 25 ohm value for the dropping resistor, and I don't know if the same value will work for an R-390A. The idea is to select the dropping resistor so that the DC voltage across the relay(s) is the same as before. Since this information does not appear to be in R-390A manuals, I suggest that you measure this value now and keep a record of it for future reference. Richard told me that the mod is easy to do in an R-389 and R-391 (Dallas Lankford and Richard Parker)

SOLDERING AND UNSOLDERING TIPS: Over the years I have worked on many fine tube type and more than a few solid state communications receivers and have had the opportunity to observe repairs and modifications done by military maintenance persons, dealers, hams, and other radio hobbyists. I have seldom seen any solder work yet, except my own and the original production line work, which was done right.

If you don't know how to make correct solder joints, go to a hamfest, buy some inexpensive electronics gear, something with tubes, lugs, and other components and a PC board full of components like you will encounter in good receivers, and unsolder enough components and wires until you understand how they are put together.

A soldering iron with a 45 watt, 900 degree element and copper tip seems optimal for working on most tube gear. A 27 watt element is about right for solid state gear. I use fine sandpaper, usually #400 and #600 wet-dry sandpaper available at most auto supply stores, and a small file to reform and clean the copper tip on a regular basis. I form my copper soldering iron tips to the shape of a blunt pencil with rounded end, or like a blunt wedge. To prepare a tip for use, I file the end to the shape I desire, sand the entire tip until smooth and shiny, plug in the iron, and touch some solder to the tip until solder flows onto the tip and tins it (covers the tip with a shiny coating). The iron is now ready to use. I use a holder for the hot iron when it is not in use. Radio Shack used to sell a cheap but perfectly acceptable soldering iron holder. I don't use steel coated soldering iron tips because the inner threads tend to corrode after some time, which makes them virtually impossible to remove from the heating element.

Some unsoldering and soldering jobs require more heat than a 45 watt iron provides. In that case I use a 100 watt soldering gun, but only as a last resort. Some people may be surprised at what a 45 watt iron can unsolder and solder. If you are the kind of person who will use a 100 watt soldering gun just because it saves you a few seconds, then you will never learn to solder well, and you will almost certainly damage some of the equipment you work on.

In my opinion a desoldering braid is essential for unsoldering wires and components in receivers and other tube gear and also works fine for PC boards. I use Chem-Wick Lite 0.1" desoldering braid. It is the only kind which works really well. I know. I have tried them all. The current Radio Shack desoldering braid is satisfactory for emergencies, but I would not use it on a regular basis.

There are two ways to desolder – destructive and non-destructive. If you are replacing a component, then it doesn't matter much how you remove it as long as you don't destroy the lugs to which it is soldered or separate the PC board traces from the board. You can cut leads close to the solder joint, remove the solder, and pry or cut the leads with a diagonal cutter blade to remove the remaining wire on the lug. But if you must reuse the component or wire, then you must try to unsolder the wire and remove it without damaging it. That requires a different approach.

My two most useful tools for non-destructive removal of wires and components from tube gear are a small curved tip hemostat and a dental probe which I filed and sanded to

a thin, sharp, angled blade on the end after breaking off part of the curve. My hemostat is not a $2.95 Pakistani special, but is the real thing ... a stainless steel, surgical grade hemostat which an operating room nurse gave me some 15 years ago. I also have a larger straight hemostat which she gave me, but I don't use it as often, and miniature needle nose pliers or the small hemostat can almost always be used instead. My dental probe is also the real thing, not one of the cheap (and useless) probes you can buy at hamfests or from industrial electronics stores and catalogs. If you are on friendly terms with your doctor and dentist you may be able to get them to order you some. Don't flinch when you are told the price. The last time I checked, I think hemostats were between $20 and $30. I wanted a spare, but after hearing the price, I decided to wait until mine broke. However, if my small hemostat broke, I wouldn't hesitate a moment to buy another, regardless of the price. The dental probe is used to pry wires away from lugs, and the hemostat is used to unbend and remove wires after they are pried away from the lugs. The hemostat is also used to crimp wires to lugs. For larger wires, like half watt resistor leads, the large hemostat is better. The hemostats and dental probes are stainless steel, so solder does not stick to them (well, almost never). This means that you can work on a solder joint with the soldering iron tip applied to the joint, which is often necessary when the desoldering braid does not remove all the solder residue.

Stranded wire is the most difficult to reuse because solder adheres to the strands. It is usually undesirable to cut off the end of a stranded wire and strip additional insulation to get clean strands because there is seldom much excess wire length. The best approach is to use a wood tongue depressor as a support, place the bare end of the stranded wire on the tongue depressor, place desoldering braid on top of the stranded wire, and apply the hot soldering iron tip to remove as much solder residue as possible. Then hold the stranded wire in one hand (some distance away from the end), and use the tip of the hot soldering iron to separate the strands. The strands can then be straightened without breaking them, twisted together, and recrimped at the lug the wire was removed from.

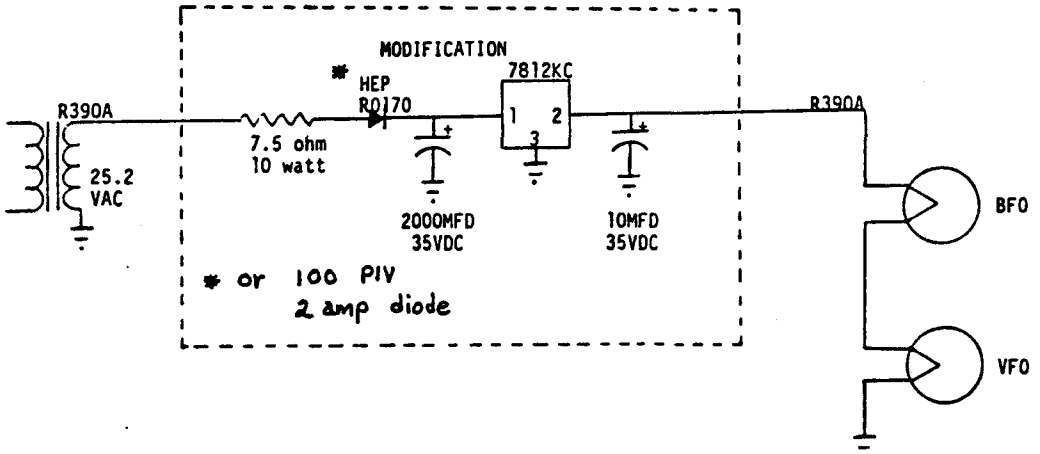
It is generally much easier to remove components from PC boards, but also much easier to damage a PC board trace. Use Chem-Wick Lite 0.1" desoldering braid to remove all solder from around the cut lead where it pokes through the PC board. Do not leave the hot iron tip applied to the braid (and hence the PC board) any longer than necessary. Excessive heat will cause a copper trace to separate from the board. With small needle nose pliers or a small screw driver straighten the lead. Do not pull down or push up or you may separate the trace from the board. Push and pull from side to side. Straightening the lead will usually break any small solder bridge with the PC board trace. If not, look closely to see where the remaining solder is, use more desoldering braid, and then straighten the lead again.

I'll conclude my tips on soldering and unsoldering with a few don't's and do's. Don't lay the end of a wire on an existing solder joint and dribble more solder onto the joint. Don't heat an existing solder joint and stick the end of a wire into the melted solder. Don't flow solder onto a joint by applying the solder directly to the hot soldering iron or gun tip. Don't apply solder to a joint with mechanically unstable wires; if anything moves except flowing solder, it is not a good solder joint. Don't cut leads at a lug and leave the cut ends crimped to the lug; if you must cut leads, then you must remove the cut ends. Don't burn nearby insulation or components with your hot soldering iron or gun tip. And there are several things you should do. Do crimp all wires firmly and securely to a lug before soldering them. Do apply a small amount of solder directly to the soldering iron or gun tip to help conduct heat to the joint if it is necessary, especially for joints with multiple wires. Do apply most or all of the solder to a joint without making direct contact with the soldering iron or gun tip. Do protect nearby insulation and components from your hot soldering iron or gun tip with pieces of wood or metal. (Dallas Lankford)

3TF7 REPLACEMENT: Here is another solution to the expensive and difficult to find R-390A ballast tube. It is taken from a MARS article by Don, AFF4MS in the March-April

1984 issue of Department Of The Air Force *Communicator*, Air Force Communications Command, HQ AFCC/TPMOG, Scott AFB, IL 62225. The schematic below tells most of the story. The article suggests removing the 3TF7 tube socket and making the circuit a permanent addition to your IF subchassis. I am opposed to that approach, and recommend that you get a 9 pin miniature tube test socket with solder lugs and make the circuit plug-in. Well, you can't quite make it plug-in because none of the 3TF7 pins are grounded. You will need a short length of insulated, stranded wire with a lug on one end to attach to a nearby screw. The 7812KC regulator package should run warm to the touch, but not hot. I don't recall who sent this article to me.

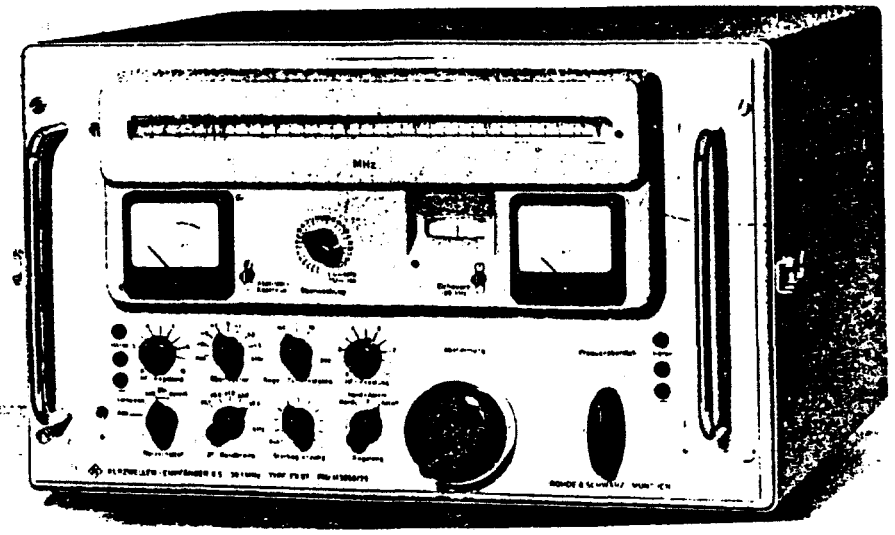
An identical circuit, apparently taken from the article above, was published in the Nov. 1985 issue of *AM Press Exchange* by B. Harp, N4GSB. I should mention that this ballast tube replacement is not as simple as Irving Megeff's dual 13 volt 5 watt zener diodes and 40 ohm resistor circuit which appeared in *HSN* **17** (Fall 1987). Also, as George Ross pointed out in *HSN* **23** (Fall 1989), after he did the dual zener mod, the 5 watt (40 ohm) resistor recommended by Megeff ran hot. It was replaced by three 15 ohm 10 watt resistors in series. This suggests that a higher wattage dropping resistor may be desirable in the mod below. If the zener diode mod is simpler, then why consider this mod? As far as I know, no one has compared these mods with each other or with a 3TF7 ballast tube to determine which one results in a more stable PTO frequency. Obviously, a performance freak would want to try all three and choose the best. (Ed.)



NRD–525 BEATS R–390A?: I can't resist a parting shot on this topic. In the March 1987 issue of *Lowdown* we read the following on page 9 of an article by Sheldon Remington. "But the newer equipment, such as the R70/R71 series, the R7A, the NRD–515 and 525, and the receiver sections of Kenwood amateur transceivers, will substantially outperform the classic hollow state units like the R–390A in this respect [dynamic range, Ed.]." I guess Sheldon doesn't know about Sherwood Engineering's narrow (2 KHz test signal separation) dynamic range comparisons where an R–390A (79 dB) beat an NRD–515 (77 dB), R7 (75 dB), and R70/R71A (62 dB) or about Magne's narrow (5 KHz test signal separation) dynamic range measurement for the NRD–525 (69 dB). Add to that the limited number of bandwidths (except for the NRD–515 and –525 which have four bandwidth choices, as opposed to six for an R–390A), poor audio, and assorted other problems of solid state receivers, and one has to wonder why people buy them. For example, both the NRD–515 and –525 suffer from limited ultimate skirt rejection (65 dB) due to signal leakage around the filters (Sherwood Engineering has a $39 mod which improves ultimate skirt rejection to 85 dB, compared to the 90+ dB ultimate rejection of an R–390A), a –525 has terrible audio on strong signals in AM mode because of audio on the AGC line (send me an SASE and $2 and I'll explain how to fix this), a –525 has bad audio generally because of hiss due

to broadband IF amplifier noise (this is harder to fix, you'll have to spend several hundred dollars for ESKAB's PLAM board and do the mod yourself), and a -525 emits RFI in the BCB, rather strongly in the 500-1000 KHz range, so that a loop antenna cannot be used effectively, much to the disappointment of MW DXers. Add to that power supply hum (which can be eliminated with additional power supply filtering) and internally generated hum (which cannot be eliminated), and you'll understand why I say that an R-390A is still the best receiver ever, solid or hollow state. (Dallas Lankford)

ROHDE & SCHWARZ EK-07-D/2: This receiver, built between 1958 and 1966, was intended for commercial reception and monitoring purposes. Uncompromizing quality and complicated circuitry make the receiver particularly useful for long term use and reception under difficult conditions. Even today, the technical specifications of this 15 year old [in 1981, Ed.] receiver are at the limits of what is possible to provide. The purpose of this report is to describe the characteristics of the receiver and how it performs in use.



Mounting Problems

With a weight of 66.3 kg (146 lb) and dimensions of 54 x 33 x 55 cm (21.5 x 13 x 21.6 in), the EK-07 is not suitable for desktop operation. It is better to mount it in an iron frame some 15 cm (6 in [? Ed.]) from the floor. In this way, operation from above is more comfortable. The antenna and loudspeaker connections at the back will in any case be rarely changed, but if so, you will have to get on your stomache. [This sounds like the receiver is mounted on its back, with front panel facing up. Ed.] The receiver is designed for normal mains use; 130 watts will be required.

High Quality German Work

The enormous front plate with the large hand drawn linear scale and the symmetrically oriented meters always impress. Buttons, knobs and switches have been designed for decades of use. Some of the adjustments do not have the satin smooth feel of some modern receivers, but they are easy to grasp and give a solid feeling. The main tuning is satin smooth. A large flywheer mass and ball bearing races make the tuning of stations a real pleasure. The ratio of coarse to fine tuning is 30:1. [Except for the lowest three bands where 3 fine tuining knob turns are required to cover 100 KHz, the fine tuning is 1 knob turn per 100 KHz, just like an R-390A. Ed]

The EK-07 has practically all the attributes we could wish for in a good DX receiver: RF gain is manually controlled, automatic or manual AGC with an adjustable treshold. The AGC time constants are adjustable between 0.1, 1 and 10 seconds. [These are release times. Ed.] BFO, noise limiting and a calibration oscillator are built in. There are 6

bandwidths from 0.15 to 6 KHz.

The visible resolution of the selected frequency is better than 0.5 KHz; the scales can be recalibrated. An AF amplifier with more than sufficient output is built in. On the front panel are two connections for headphones; the connection "narrow" is fed through a complicated LC filter and is particularly suitable for CW reception.

The mains switch has a position which has completely disappeared from modern receivers: Preheat (Standby). In this mode of operation only the valve heaters are connected. The HT voltage is then switched on with the "bright" (Hell) position, and off with the "dark" (Dunkel) position. Bright and dark refer to the frequency scale lighting, which only has any significance when the radio is actually in use.

The right hand meter shows the AF level at the loudspeaker or line output. It is also used as a meter when checks are carried out on the whole receiver with the knob "Performance Check" (Überwachung). The knobs for "Tuning Check" and "Crystal Calibration" permit an exact adjustment of the separate range scales with a received frequency. The large linear frequency scale covers a range of 3 MHz with 9 separate bands above 3.1 MHz. Below 3.1 MHz the division is different: 0.5–1.1 Mhz, 1.1–2.1 MHz and 2.1–3.1 MHz. All of the ranges are selected with the large flat switch (bottom right) which operates a series of tunes on a turret tuner. [Like the SP–600?! Ed.]

At the back of the receiver access is provided to the main oscillator, other oscillators, various IF frequencies, as well as the AF crystal calibration frequencies for various test purposes. The AGC voltage is also accessible and the EK–07 can be used in diversity mode when other similar receivers are available. Then the receiver only takes the best available signal.

Antennas are connected to a coax or a simple 4 mm socket. When the receiver is used in connection with a transmitter, a mute switch can be operated by a relay from the transmitter.

The 27 valves [tubes Ed.] of the EK–07 require a ventilator fan which is also at the back. The quiet humming of the ventilator is annoying during long periods of use. After removing four screws, the whole receiver can be slid out of its steel case. Operation out of its case is only possible with the aid of a special connector (20 way) which could be a disadvantage for alignment or repair. [Why can't adapters be fabricated? Ed.] The test receiver only required the replacement of a fuse and the replacement of a low noise valve for the RF amplifier. I ordered a second fuse and this should last for the next 15 years: that is a measure of the standard of workmanship. [Apparently a special fuse is required. Ed.]

Some Details

A detailed circuit description is not possible within the limits of this article. A short description of circuitry gives a good idea of the extent of the effort which has been put into this receiver.

The antenna voltage reaches the first mixer after passing through a three stage preselector. Signals between 0.5– 3.1 MHz and 3.1MHz–6.1 MHz are converted to a first IF of 300 KHz; the receiver is a single superhet. [Images? Ed.] From 6.1–30.1 MHz a 1st IF of 3.3 MHz is used, and then a 2nd IF of 300 KHz again.; here the receiver is a double superhet. At the end of each 1st mixer stage is a complicate 4 pole filter, and after the 2nd mixer (i.e., ahead of the 300 KHz IF transformer) is the four way selectable IF bandwidth. In the narrow setting, a real double crystal filter is used. There are three other IF stages with complicated three and four pole filters. After this, the signal is envelope demodulated, or the BFO is switched in. A switchable and adjustable noise limiter is before the AF amplifier.

The AGC circuitry is unusually complicated: there are three different types of controls which operate on seven valves. The completely modern form of generation of the oscillator frequencies is the particular feature of this receiver: a special form of PLL [phase locked loop Ed.] is used. There are several forms of compensation for temperature, aging,

valve changes, etc., which give this valve receiver an unusually good short and long term frequency stability. An extremely accurate crystal calibration receiver [crystal oscillator? Ed.] permits the calibration of the frequency scale every 300 KHz. Between these points the accuracy of the calibration is better than 0.5 KHz. The mains supply is protected from mains borne interference and the HT is stabilized.

A very complicated test system is built in for quick checking of correct functioning or fault finding, which from a switch on the front panel can locate faults to a particular stage in a few seconds. The internal construction is modular; whole groups can be removed and replaced.

How complicated this receiver is can be seen from the master oscillator. The unit is contained in a thick cast metal box. A silica gel package compensates for humidity changes. In case this oscillator has to be aligned, there is not only the normal L/C adjustment, but in order to be able to have the most accurate possible readings from the frequency scale, 32 separate trimmers (on the tuning capacitor!!! translator) can be adjusted.

All components have been tropicalized. All metal components are either rust free or have been specially treated. The visible degree of effort expended on fine tolerance engineering with tiny chain drives, worm gears, etc., can hardly be described in words. This receiver cost DM 25,000 [over $6,000 Ed.] when made. Nowadays (1981) such a receiver could not be made for twice as much considering the complicated mechanics. The modern successors, e.g., EK–070, replace mechanics with complicated microprocessor technology and in this way the receivers have become much smaller, lighter and cheaper. The specifications of such newer receivers only improve on their predecessors with respect to the accuracy of the frequency display. [Well, not quite. All aspects of such modern receivers are microprocessor controlled. Ed.]

Selectivity, sensitivity, large signal handling and AGC performance of the old EK–07 are now, as then, simply first class.

Practical Operation

The usual mode of operation is unfortunately only for A1 to A4. For SSB reception, a special adapter (NZ–10) is requires, which is unfortunately no longer manufactured. The biggest problem is, as I mentioned, mounting the radio. When you have solved that problem, the gray monster gives you a reception experience that only the NRD–505 in the amateur category can match. [Come on! An R–390A is surely the equal of an EK–07 by any measure you want to use. I think an R–390A is superior for obvious reasons. Ed.] Whether long wire or active antenna, frame aerial or directional ferrite antenna, in all these areas the EK–07 leaves nothing to be desired. The frequency readout accuracy of 0.5 KHz is adequate. The signal strength indicator is a great help when different antenna are connected as it shows a true input signal level. The manual adjustment is excellent in the thickly populated tropical bands. The selectivity of 1.5 KHz is adequate for every sort of interference. The wider filters permit an unusually clean AF when the reception conditions permit it.

This Rolls-Royce is not entirely free of criticism: a notch filter was badly missed [and difficult to add because of the 300 KHz IF, Ed.] as well as an internal speaker (Why? Who uses a 146 lb receiver as a walkman? translator). The built-in noise limiter takes away some of the AF and produces unacceptable distortion at the end of its frequency range. A notch filter would be better here. Both of the meters had no illumination which required that the whole receiver be taken out of its case just to change a fuse. The running noise of the fan is annoying during quiet evenings when one is listening with a loudspeaker. As is usual for all valve radios, one has to wait after switching on until the valves can have the HT applied (Barkhausen one minute's silence). [Do you suppose we should switch an R–390A to STANDBY for 1 minute before applying power? Ed.] As with all radios of this type, full stability is only reached after about 60 minutes' warm up, which is usual and is not a fault.

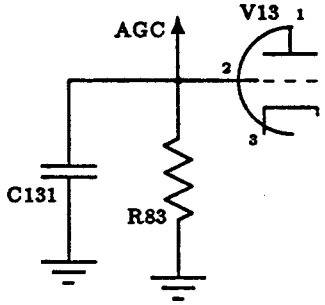
The remarkable frequency stability is shown, for example, in combination with a RTTY

decoder (Theta 350). After the required warm up period, the radio can be used for hours without any adjustment, The versatile connections at the back can be used in the laboratory in connection with reception tests, whereas special receivers with these facilities are prohibitively expensive. For this reason, the EK–07 is used in the WWH Technical Lab (Lichte's own lab, I believe, translator) after the specifications of the radio have been confirmed in a series of extensive tests.

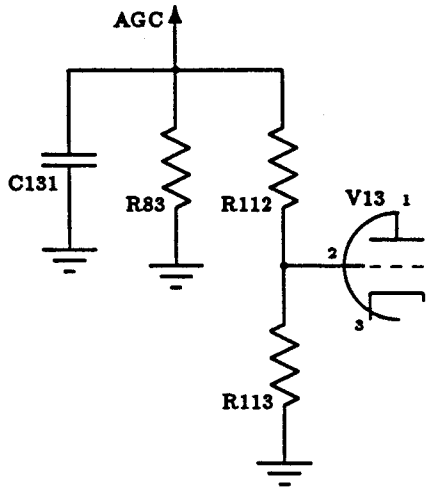
Size, price, operating comfort – there is no modern digital display – mean that this receiver is not to everybody's taste. However, this vintage radio can still deal today with any DX reception. (Rainer Lichte, translated from the German by Denzil Wraight, from an unknown 1981 publication)

[There was another page of specifications from Denzil Wraight's translation of Rainer Lichte's article which I have not included because most of the information has already been stated in the article. The article and spec sheet left me confused about the selectivity bandwidths for the EK–07. Three bandwidths (6/60 dB) were mentioned specifically in the spec sheet: 8/26, 6/14, and 4/9 KHz; two bandwidths (presumably 6 dB) were mentioned in the article: 0.15 and 1.5 KHz. However, the article stated that the bandwidths were 0.15–6 KHz, which is not consistent with the spec sheet. The spec sheet gave the following additional information: sensitivity – better than 15 microvolts, 0.5–3.1 MHz, better than 2.6 microvolts, 3.1–30.1 MHz; audio power – 2.4 watts at less than 10% THD; audio frequency range – 33 to 6,400 Hz with 3 dB variation; power required – 110 or 220 volts, 135 watts; IF rejection – about 75 dB; AGC control range – about 92 dB. No image rejection figures were given. Denzil told me that the /D from EK–07/D signifies the German version, and the /D1 and /D2 signify different connectors on the rear panel. The front panel view at the beginning of Denzil's translation is taken from the article "Die deutsche Antwort auf Collins? Rohde & Schwarz EK 07," (The German Answer To Collins? Rohde & Schwarz EK 07), pages 99–103, *Oldie KW-Empfanger*, by Nils Schiffhauer, Baden-Baden, 1987, ISBN 3-88180-302-5. Ed.]

HQ–180 S-METER AMP CORRECTIONS: In my article on HQ–180 S-meter amp variations which appeared in *HSN* 17 (Fall 1987) there were errors: the third schematic from the left, called "Early HQ–180A," does not correspond to any HQ–180A, the second schematic from the left and the last (fourth) schematic from the left should be labeled as below. In addition, below I have shown C131 as part of the RC networks at pin 2 of V13 where it is wired, although it is shown at a distant position on the HQ–180 manual schematic. The values for C131, R83, R112, and R113 are 0.01 mF, 4.7M, 2.2M, and 4.7M respectively.



HQ–180 and HQ–180A, series 1 and 2



HQ–180A, series 3 and 4

51J-4 PRODUCT DETECTOR AND AGC MOD: After warning everyone about untested mods on page 6 of *HSN* **22** (Spring 1989), I should have followed my own advice. But curiousity and a spare 51J-4 which had already been "chewed on" a little prompted me to try a product detector and fast attack, slow release AGC mod. I used a variant of Commander Paul H. Lee's product detector with component values determined to some extent by the already existing component values in the 51J-4. Fortunately, I had all the articles about 51J product detector and AGC mods on hand, including Frisco Roberts' remarks (from "Comments" on page 6 of the Oct. 1978 issue of *Ham Radio*) about adding a 10 mF electrolytic at the junction of the screen and plate resistors to cure a motorboating problem. Naturally, my product detector mod motorboated. Happily, Roberts' fix took care of the problem. Unhappily, as I mentioned in *HSN* **22**, the AGC mods suggested by Scherer, W2AEF and Orr, W6SAI were uniformly disappointing for various reasons. However, I persisted, and eventually developed an AGC mod which is fast attack and slow release, and gives satisfactory results on SSB/CW and AM. That is the good news. The bad news is that it requires replacing the BFO switch with a switch which is not an off the shelf item, and it requires a difficult to find cable clamp as part of rewiring the cable bundles attached to the back of the front panel. Also, the mod takes many hours. But if you just have to try this mod, send me a large SASE plus two $1 bills, and I'll send you about 25 pages of my notes and drawings which should be sufficient for you to duplicate my mod. (Dallas Lankford)

SECRETS, TRICKS, CHEMICALS, ETC.: Joe Bunyard and I have discussed doing a "Hints and Kinks" or "Tips" contribution for some time. With each of these techniques, you should practice it first on a similar piece of material before using it on your favorite receiver or other piece of equipment. If you don't have a similar thing on hand, attend a hamfest or order some junk from Fair Radio. In the credits, (JB) will denote Joe and (DL) will denote me. (Ed.)

Removing Varnish Sealed Screws

In commercial (51J series receivers) and military (R-3XX receivers) equipment, screws and set screws are sometimes sealed ("frozen") with varnish, often green varnish. For example, the #2 Phillips screws on the R-390A antenna relay, the spline set screws on the BFO PTO bellows coupler, and many set screws in the 51J series receivers come immediately to mind. I you see any green varnish around such a screw or set screw, don't even try to remove it. Get out your soldering iron (I use a 45 watt iron with a pencil point tip), heat the iron, and apply the tip directly to the screw, set screw, or set screw hole for about 20 seconds. Then try to remove the screw. If it does not turn with reasonable pressure, repeat the heating procedure for about 30 seconds and try again. I have never stripped a screw with this procedure. (DL)

Polishing Plastic

Toothpaste is an excellent plastic polish. I first read about using toothpaste to refinish dull or scratched plastic meter face covers in an old *73 Magazine*. If scratched, sand the meter cover dull smooth in one direction only using 0000 steel wool. Then polish it using toothpaste and your finger. It works. (JB)

Novus #1 and #2 plastic polish, available from Antique Electronic Supply of Tempe, AZ, works great. Directions are on the bottles. We have used it to clean and polish 51J knobs and meter face covers. (JB & DL)

Joe Bunyard is the expert on polishing plexiglass. Somewhere I have a detailed description of how Joe polishes plexiglass edges after they have been cut with a saw, but I can't find it (and it may be too long for this farewell issue). It involves sanding the surface smooth, using several grades of jeweler's rouge with a (motorized) buffing wheel, and finally using Novus #2 and #1 (by hand?) to remove the yellow haze left by heat of the rouge if I remember correctly. His results are amazing. If you need to polish plexiglass, write me (include a SASE) and I'll try to find Joe's description, or maybe talk Joe into corresponding with you. (DL)

Rumor has it that Brasso works fine on plastic. The Vietnamese are supposed to sand dull watch crystals to remove scratches, and polish the dull finish with Brasso. (JB)

Joe sent me a copy of some pages from "Secrets Of Corvette Detailing" which describes various techniques of plastic refinishing and polishing. It begins, "Scratched or cloudy plastic can be brought back. The trick is to remove the damage with a fine abrasive, then proceed through a series of finer abrasives until the surface is clear again." Among the abrasives mentioned are 600 grit sandpaper (available at auto parts stores, ask for #600 wet-dry sandpaper) dulled by rubbing two pieces together, jeweler's rouge (any good hardware store has it), regular car wax, rubbing compound and polishing compound (at any discount store), Meguiar's Sealer and Reseal Glaze, Blue Magic Metal Polish Cream and Ultra Finish (made by Liquid Glass of NJ). (DL)

White Filled Engravings On Black Plastic Knobs

Lacquer Stik, available from Antique Electronic Supply of Tempe, AZ, is just the thing for refinishing HQ-180 knobs and probably 51J knobs after you have cleaned and polished them. Cleaning and polishing often removes the white lines. Lacquer Stik is a solid white lacquer, very thick. You rub it into the engravings and wipe off the excess. (DL)

Liquitex Acrylic Artist Color, available at all artists stores and Wal Mart, can be used to refinish engraved knobs and dials, and is available in titanium white for late date military gear and parchment white for the antique look. (JB)

Cleaning Front Panels And Other Surfaces

Go Jo or Goop or any lanolin, jelly-type hand cleaner is a favorite of mine for cleaning front panels. You can let it sit on them. I use a toothbrush with Goop in the R-390A front panel engravings. It works wonders. (JB)

Spray N Wash is supposed to remove calibration sticker residue from front panels. I have never used this, but I know that Goop works well for this task. (JB)

Mineral Spirits is a good, safe, general purpose cleaner, and is easy to buy as charcoal lighter fluid. (JB)

Lacquer thinner is a much stronger solvent than mineral spirits, and should be used with caution on delicate or painted surfaces. However, for tough jobs it is much better than mineral spirits. (DL)

** Choke cleaning solvent, such as Berryman B-12, is a super powerful solvent useful for cleaning grease encrusted R-390A RF deck gears and racks. Remove the RF deck from the R-390A and remove the Veedor Root counter from the RF deck before using these solvents. (JB & DL)

A brass bristle brush is useful for cleaning grooves in metal surfaces, and won't damage the metal surface. (JB)

Polishing Metal

Nevr-Dull is the best metal polish you will ever use. I don't use anything else for my radio hobby work. If you can't find it in a nearby store, call The George Basch Co., Inc., Freeport, NY 11520 for your nearest distributor. Nevr-Dull is excellent for brass, nickel, and silver plate. Tarnished plated screw heads can be polished by wrapping the threads in thin rubber (a piece of bicycle tire inner tube), inserting the wrapped threads in your drill, and applying a piece of Nevr-Dull while spinning the screw head. Be careful what you use Nevr-Dull on. Some metal surfaces are chemically treated to retard rust and corrosion (some gold colored surfaces in 51J and R-3XX receivers). Nevr-Dull will remove the colored chemical surface. (DL)

Brillo Nylon Scrubber Pads, or SOS Pads, or Scotch Brite Pads (all the same kind of pads) can be used just like fine sandpaper, seem to come in different coarseness, and leave little gritty residue as you get with sandpaper. These will clean, smooth, and shine metal surfaces without scratching or removing metal. They are great. (JB) I agree. I used some recently to clean a PC board before and after etching. These pads are much better than steel wool. (DL)

** After the above was written, I learned that most solvents contain an acid which is used to dissolve the fibers which are normally contained in grease. You should not use such solvents, such as B-12, on R-390A racks and gears. NAPA Brake And Electric Motor Cleaner is the only solvent I know of which does not contain acid.