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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.**

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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.]