THE HOLLOW STATE NEWSLETTER

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Publisher's and Editor's Corner

Excuse me, everyone, including Ralph, for being so late with issue number 28. I had every intention of last year being a "normal" 4 issue year, but it just didn't happen. As I have said before, sometimes our normal jobs and activities take priority over our hobby activities. And please remember that Ralph and I do not get any pay or make any profit from the newsletter.

The main topic of this issue is the long awaited product detector for the 51J-4. It is not an easy mod, but well worth the effort.

My how time flies when you are having fun! Come next fall I will have been editing HSN for 7 years. That is a long time folks, and I have been thinking that it might be a good idea to try to find someone new to take on the job of editing HSN. Ralph has also mentioned that in a year or two he might like to turn over the publishing job to someone new. Any volunteers for either of these jobs? I would like to exchange letters, and perhaps a few phone calls with anyone interested in either position. I don't intend to drop out of the hobby, but as I have grown older with the passing years I find that I would like to take life a bit slower. But don't worry. There is still a lot of life left in me. Wally and I are planning to do a definitive article on rebuilding R-390A PTOs, and I have just recently figured out how to open and fix most defective R-390A meters.

Short Contributions

R-390A AGC/BFO Mod: (We get letters. Ed.) Dallas, I have performed your AGC/BFO mod to one of my R-390A's. I wanted to let you know that I am very pleased with the results. Your (and don't forget Wally's, Ed.) many hours of work involved in this mod are much appreciated here. I modified a pretty hot EAC unit. With a good outside antenna I can run the RF gain full on even for strong SSB/CW stations. In my opinion, the audio is only slightly below a receiver with a product detector and good AGC. The side effects I have noticed are a slight reduction in audio (as you mentioned) and that the noise limiter control seems

to kill the audio when you advance it much beyond the 11 o'clock position. I do not remember my noise limiter doing this before. (Byron Tatum, WA5THJ)

R-390A AGC Problem and Fix: An R-390A of mine would work nicely for about 10 minutes from a cold start, then the receiver would exhibit distortion and blocking, which worsened as the unit heated up. A check of the AGC voltage on the rear panel revealed lower than normal AGC voltage (typically -4 to -7 VDC compared to "good" AGC voltage of -8 to -15). I went to work on the IF subchassis by measuring the resistance between pin 6 of J512 and ground, measuring 1.5 Meg (it should have read infinity). I suspected a leaky capacitor, but all candidates were OK. After isolating all of the AGC tie-ins on the IF deck (I assume you unsoldered the AGC line at various points, Ed.), the mechanical filter assembly was identified as the culprit. However, its bypass capacitor (C512) was OK. The only remaining possibility was one of the mechanical filters (AGC voltage is applied to V502 through the coils of all mechanical filters). To find the bad mechanical filter, I had to unsolder all leads on both terminals (of each mechanical filter) at the "AGC end" of the mechanical filters. The resistance between either terminal and the filter case should be infinity. For the 8 KHz filter, the "cold" resistance was 1.5 Meg, and when heated to 145 degrees with a hair dryer, the resistance was 300 K ohms. The 8 KHz filter sounded fine in use with the RF gain control reduced to eliminate overload. I hope this saves someone a lot of time. (Byron Tatum, WA5THJ) This gets my vote for the "strange problem and outstanding fix" of the year award. (Ed.)

TV-10B/U Tube Tester Problems and Fix: As I said many moons ago in the special issue on test equipment, the TV-10 is, in my opinion, one of the best tube testers around. Recently I bought a 10B sight unseen, thinking it would be more or less like the 10A which I already had. It was supposed to be in good electrical condition, but, of course, it wasn't. After several weeks of working on it, I believe I finally have it fixed, and you may be interested in my experiences. The most common problem with military tube testers is that often the 7 and/or 9 pin miniature tube sockets are literally worn out (from 1000's, maybe 100,000's of tube insertions and removals). This 10B had already had the 9 pin socket replaced at some point in the past, but with an incorrect type of 9 pin socket and with poor solder work. So the first order of business was to remove the botched repair, and do it right. After that was done, it was discovered that some pins of the 9 pin socket were shorting (as indicated by the SHORTS lamp glowing continuously when the FUNCTION SWITCH was in several of the SHORTS TEST positions 1 through 5), with no tube in the socket. This problem was traced to several bent lugs on the under side of the LOCTAL socket which had brought those lugs into contact. One can imagine any number of ways that the lugs could have been bent. Nothing extraordinary here, just the usual "gorillas" at work. While I am on the subject of sockets, I should mention that the 9 pin socket I used for this repair was a Fair Radio used 9 pin socket. I have learned the hard way that many of the brand new tube sockets you can buy at ham fests or from electronics suppliers are worthless: the lugs don't take solder properly, the contacts don't hold up well under repeated use, etc. After replacing the 9 pin socket and bending the LOCTAL socket lugs away from each other, I tested some tubes. Meter readings were not stable with either 7 or 9 pin tubes, and some of the 7 pin contacts pulled part way out of the 7 pin socket when a 7 pin tube was removed from the socket. So I replaced the 7 pin socket, and looked around for the cause of the unstable meter readings. In many tube testers, like the TV-10 and TV-7, the screen voltages (high and low) are obtained from variable taps on an 8500 ohm or 9500 ohm 10 watt wire wound power resistor. Inspection of this resistor in the 10B revealed that under one of the variable taps the turns of wire had been broken. The quickest and easiest fix for such a problem is to use 9 or 10 Radio Shack 1000 ohm 1 watt resistors in series

mounted on a Radio Shack "proto PC board" cut down to a smaller size with hand nibblers, with small holes drilled in the end so you can use cable lacing to tie the assembly to a nearby cable bundle. Some test lead clips were used to determine the proper tap positions before soldering the wires (which previously went to the power resistor variable taps) to the new resistor assembly. At first that seemed to have fixed the unstable meter reading problem, but then the problem returned. For a while I thought there was a problem with the contacts of the red mutual conductance button, because it seemed that the meter needle could be made to move around by wiggling the red button (while the red button was pressed, with a 6BA6 tube under test in the 7 pin socket). I burnished the mutual conductance push button contacts, but that didn't help. I even squirted the contacts with some R-5 DeOxIT (a new high tech deoxidizer a friend sent me), but alas, to no avail. So it was "back to the drawing board." Curiously, I had noticed that when 9 pin tubes were tested, meter readings were stable. It was only when 7 pin tubes were tested that the meter needle meandered all over the place. What did it mean? Part of my problem was that I had no 10B manual, and was using a 10A manual. While the 10A and 10B are similar, they are not identical. Was I missing something? I measured the operating voltages per the 10A manual, and they seemed rock solid stable (although, perhaps, the plate voltage was a bit high). I studied the 10A schematic, but saw nothing that could account for this curious problem. Finally, I considered the 9 pin socket replacement which had been done previously. If that person was dumb enough to use the wrong type of socket, could he have thrown away some parts, like ferrite beads slipped over the bare wire adjacent to some of the tube socket lugs? My 10A had ferrite beads slipped over the hook-up wire adjacent to just about every tube socket lug. The 10B had virtually no ferrite beads. Could it be that parasitic oscillation was causing the meandering meter readings for 7 pin tubes under test? It was worth a try. I had plenty of Amidon FB-101-64 ferrite beads which I use for suppressing parasitic oscillation in FET amps, and they were about the same size as the ferrite beads used in the 10B. First, I added a ferrite bead to the pin 1 (grid) lug lead. The problem remained. Next I added a bead to the screen lead, but still the problem remained. Finally, I added a bead to the plate lead (pin 7), and the meandering meter reading problem was gone! (Oops. I should have added that pin 6 was the "screen lead" above.) It would appear that one or more ferrite beads were removed and discarded during some previous attempted repair. Naturally, I don't know how many beads were removed, or from which wires (at which lugs) they were removed. Knowing what I know now, I would recommend that an Amidon FB-101-64 ferrite bead be used at each lug of the 7 and 9 pin miniature tube sockets. That may be overkill, but it certainly won't cause any problems. (Dallas Lankford)

HSN Index: Thank you Geoff Greer for compiling a detailed index for issues 1 through 24/25. The index is 5 pages, single spaced headings, each heading identified by issue number and page number. Geoff has provided us with a very convenient way to locate topics in our growing collection of HSN. And he has kindly given permission for HSN to sell copies of his index. If you want a copy, send Ralph $2 (address at top of front page) and he will gladly send you a copy post paid. (Ed.)

R-3XX Relay Problems: I thought I should write and let you know that I tried the relay problem fix for my R-391 which was described in HSN #24/25. It works very well, except that here in Australia a 25 ohm 25 watt dropping resistor is not an off the shelf item. One has to be specially made (for about $22). (John O'Sullivan) Thank you for letting us know that the mod worked well. John also said that Richard Parker was quite helpful in providing him with additional information. Has anyone had any problems with R-390A relays yet? (Ed.)

51J-4 Product Detector Mod

Dallas Lankford

As hollow state buffs know, the Collins 51J-4 is a classic tube type communications receiver. It was and still is one of the finest AM receivers ever built. Two things prevent it from being outstanding for SSB and CW - it has no product detector, and the AGC attack and release times are not suitable for SSB and CW. The purpose of this note is to describe how to convert the BFO circuit to a product detector. I have already discussed a suitable AGC circuit change in my article "51J-4 fast attack - slow release AGC mod."

Several articles have been written about the 51J and R-388 receivers which describe how to convert the BFO circuit to a product detector and modify the AGC circuit for fast attack and slow release. But none of them apply directly to the 51J-4, and all of the AGC mods, except mine, suffer from one or more serious problems, especially bad overshoot which manifests itself by a loud thump at the beginning of SSB trandmissions.

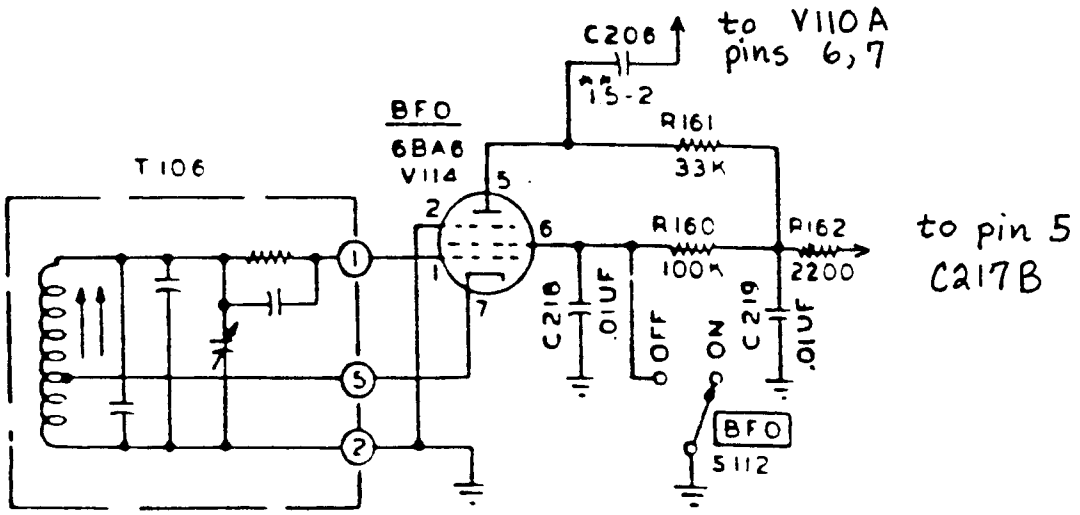


Fig. 1 — 51J-4 BFO Circuit

The 51J-4 BFO circuit is shown above in Fig. 1. I intended to convert the BFO circuit into the product detector described by William Orr in his February 1978 Ham Radio article, "Modifying the 51J receiver for SSB reception," pages 66-69, but a remark by Wilfred Scherer in his December 1968 CQ article, "More on updated improvements for the 51J receivers," pages 64-69, 116, caused me to use different component values. Scherer said that with a 56K plate and 2.2K screen resistors as recommended by Commander Paul Lee in his April 1961 CQ article, "The single tube product detector," pages 50-51, 118, 119, strong BFO harmonics were found at every 500 KHz point up to 7 MHz. The original 51J-4 screen resistor, R160, was 100K, 1 watt, so I decided not to change its value to 22K as suggested by Orr, but leave it as is because Scherer used a 330K screen resistor. The original 51J-4 plate resistor, R161, was 33K. Since I had to uncrimp and disconnect one end of R161 at pin 5 of V114 in order to access and remove C206, I decided to remove and completely replace R161 with a 47K, half watt resistor, about the same as suggested by Orr, and about half the value used by Scherer. In addition, I used an inductive pi network low pass filter instead of the resistive network used by Orr, Scherer, and Lee. The 1 mH choke and 560 pF input and output capacitors were what I had on hand. For a 2.5 mH choke you should use 220pF capacitors, and for a 5 mH c use 100 pF capacitors.

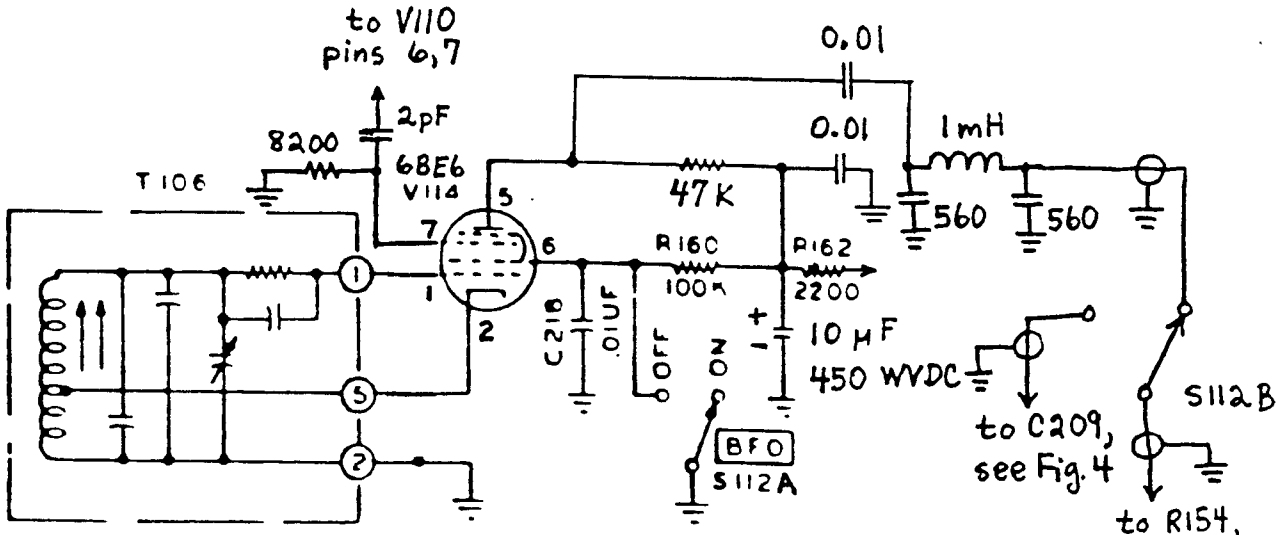


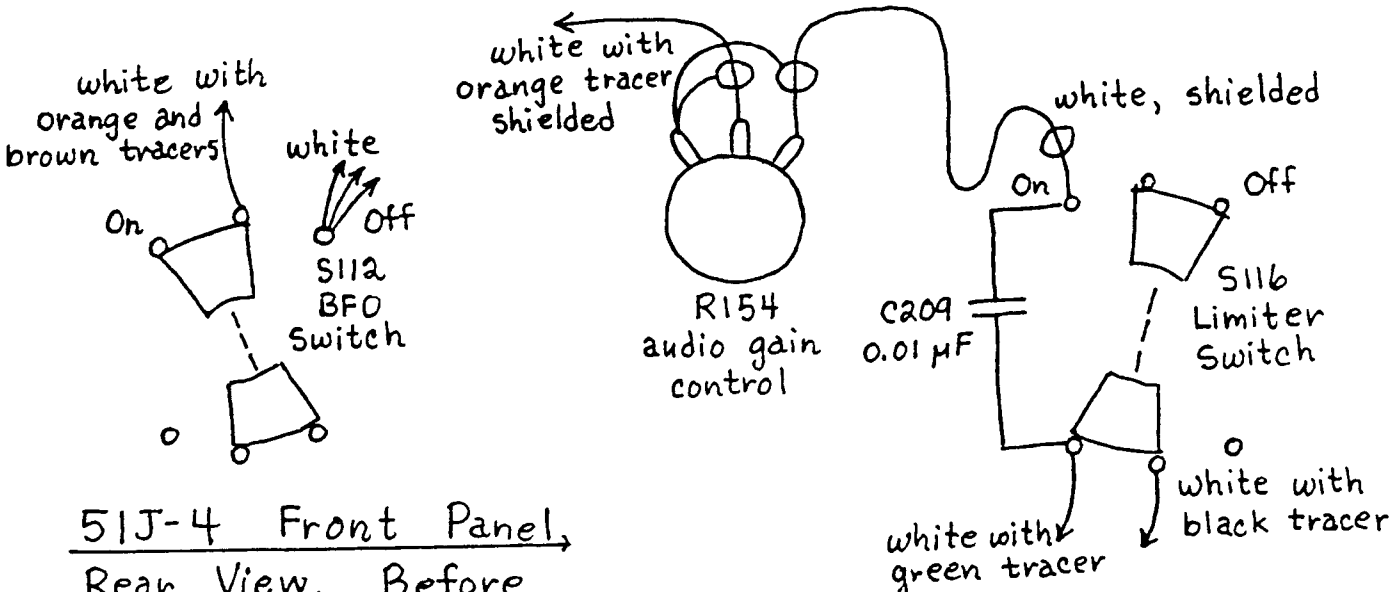
Fig. 2 — 51J-4 Product Detector

(Note: I neglected to mention in the article that I used a 0.01 1KV disc ceramic capacitor in parallel with the 10 mF electrolytic which replaced C219.)

The product detector I used is shown above in Fig. 2. Orr advised that the 6BE6 oscillator voltage at pin 1 should not exceed 10 volts peak to peak. With the 100K screen resistor I used, the oscillator voltage at pin 1 is about 8 volts peak to peak. The audio output level of the 6BE6 product detector can be adjusted by varying the capacitor and resistor voltage divider at pin 7 of the 6BE6. I used a 2 pF capacitor because that is what I had on hand. Orr, Scherer, and Lee used a 5 pF capacitor. I determined the value of the 8200 ohm resistor by trial and error. I wanted the audio levels to me more or less equal when I switched between AM and CW. For a 5 pF capacitor, start with a 3300 ohm resistor, and increase it or decrease it for more or less audio output.

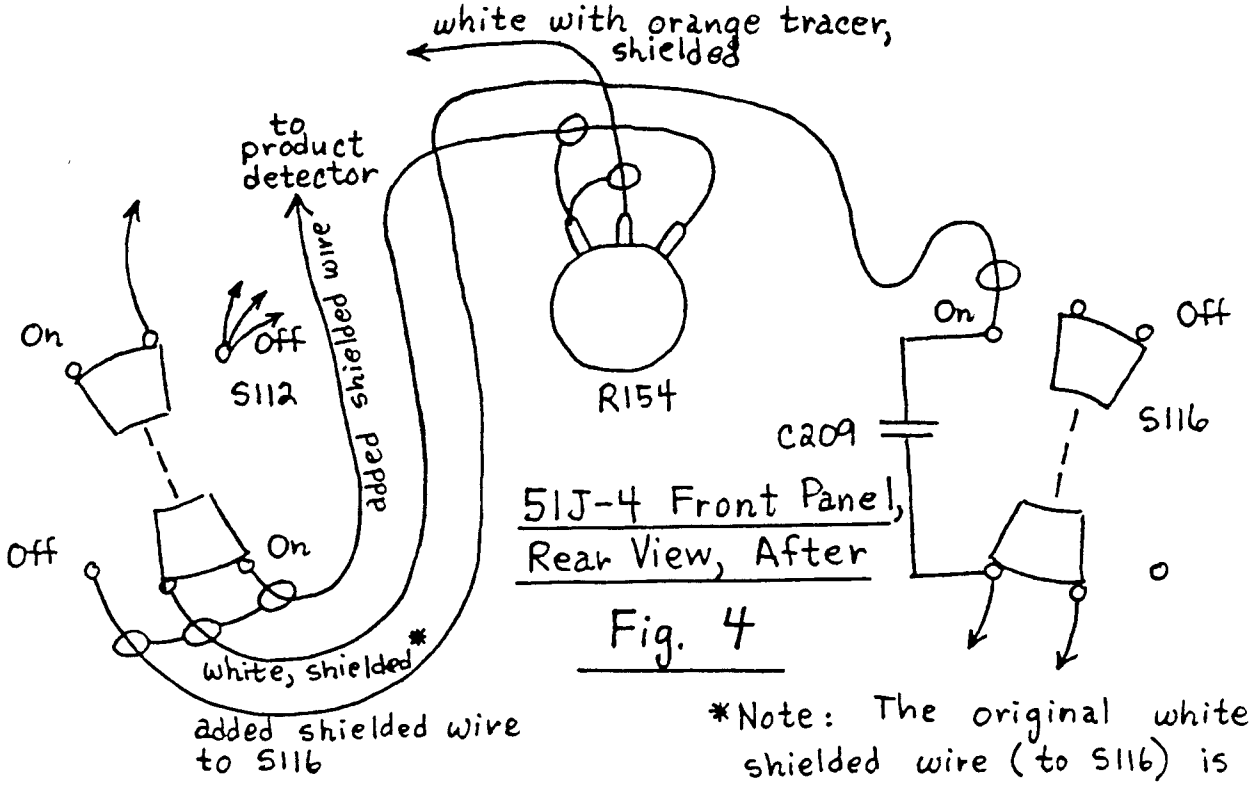
Notice the 10 mF 450 WVDC electrolytic capacitor which replaced C219, 0.01 mF. All of the previously mentioned articles said nothing about replacing C219 by a 10 mF electrolytic. Fortunately, I had done my homework and had found the comments by Frisco Roberts in the October 1978 issue of Ham Radio, page 6. Roberts said that after he added Orr's product detector to his 51J receiver, the audio output motor-boated at higher audio gain control settings. He determined that the motor-boating was caused by B+ hash (presumably he meant B+ ripple). So I was not surprised when my product detector motorboated. Following Roberts' suggestion, I replaced C219 by a 10 mF electrolytic and the problem went away. In my opinion, you should not even consider using a 6BE6 product detector without this 10 mF electrolytic.

According to gossip, many hams have tried one of these 6BE6 product detectors in their 51J or R-388, and were not satisfied with the result. Perhaps they experienced motor-boating and were not informed of Roberts' diagnosis and cure for that problem. Perhaps they experienced strong BFO harmonics up to 7 MHz and were not aware of Scherer's diagnosis and cure for that problem. Perhaps they got unsuitable audio output level from the product detector and did not know to vary the capacitor and/or resistor at pin 7 of the 6BE6. Perhaps my LC low pass filter avoids problems I did not encounter with the RC low pass filter used by Orr, Scherer, and Lee. Perhaps I got lucky with my component layout and did not encounter problems experienced by others. Or perhaps many hams were not satisfied with the AGC mods suggested by Orr and Scherer. (I wasn't.) The bad overshoot of the AGC mods described by Orr and Scherer is enough to turn anyone off.



51J-4 Front Panel, Rear View, Before

Fig. 3



51J-4 Front Panel, Rear View, After

Fig. 4

*Note: The original white shielded wire (to S116) is not long enough to reach S112.

Before describing the layout of the product detector, let me explain how the switching between AM and SSB/CW is done. In all 51J-4s I have seen, the BFO switch, S112, has an unused section which I have labeled S112B in Fig. 2; see Fig. 3 for a rear view of the front panel before modification. If you will study Fig. 4 and the 51J-4 schematic, you will see that S112B is used to switch between the output of the noise limiter for AM and the output of the product detector low pass filter for SSB/CW.

To access the BFO and limiter switches and audio gain control, the 51J front panel must be removed. You should do this part of the product detector mod first in case the switches are not of the type I have drawn in Fig. 3 and Fig. 4. If the switches are not of the type I have drawn, you will need to obtain similar switches. You should observe that there is not much clearance behind the front panel, so not any switches will do. If the wire tracer colors are not as I have shown, you will have to determine how your 51J is wired. At least I have given you a starting point. When I rewired my front panel, I cut all the wiring harness lacing, ran my new wires along the existing wiring bundles, and relaced the modified bundles with new lacing. The three shielded ends at S112 were soldered together and tied down with cable lacing. The shielded wire to the product detector was run along the taped cable bundle which branches just inside the front panle and runs along the side panel to the rear compartment. I temporarily removed the filter chokes from the side panel (but did not unsolder them) to access the taped cable bundle along the side panel. I used plastic cable ties to secure the product detector shielded wire to the taped cable bundle. I made a right angle turn in the product detector shielded wire where the taped cable bundle makes a T intersection in the rear compartment, and brought the product detector wire out beside the plug-in electrolytic capacitor bracket near the BFO coil. The shielded end of the shielded wire to the product detector was grounded at the low pass filter near the 6BE6 product detector; see Fig. 5. One of the cable clamps on the front panel will have to be replaced with a larger clamp. The original clamps are #1 Tinnerman clamps, so you will need a #2 Tinnerman clamp if you want to preserve the appearance of your 51J-4. The #2 clamp is larger than necessary, and I used a small piece of rubber to make a tight fit.

The product detector layout is shown in Fig. 5. Any component or wire removed from a lug was replaced with a new component or wire. In particular, I removed the 2 pF BFO coupling capacitor, the 33K plate resistor, the 0.01 mF screen bypass capacitor, the 0.01 mF bypass capacitor from the insulated standoff to ground, all wires from the tube socket to the BFO coil, and the ground wire from the center post of XV114 to pin 2. I wired my 51J-4 slightly different than shown. I used a Teflon insulated wire from pin 5 of V114 to the insulated standoff at the low pass filter, and I ran this wire under the filament wires at pin 4 and between that tube socket ground lug and pin 3, under the wire from pin 3 to the ground lug. If you cannot obtain insulated, stranded, Teflon wire, you should run the wire from pin 5 to the insulated standoff as I have shown (in case the screen bypass capacitor ever needs to be replaced, soldering iron heat applied to the ground lug could damage the insulation). Some consideration should be given to the order in which new components are added. I installed the 47K resistor first, and then installed the 2 pF capacitor above the 47K resistor (since a 2 pF capacitor is more likely to fail than a 47K ohm resistor). The 0.01 mF screen bypass capacitor was curved away from the tube socket as shown so that the component density would be less, and so that the tube socket pins could be accessed more easily. I also found it convenient to remove the 0.01 mF capacitor from the plug-in electrolytic capacitor bracket to V113 while dressing the ends of the wire and shield of the shielded wire to the front panel.

When using the product detector for SSB, the BFO frequency will need to be offset to one side or the other of center frequency depending on whether USB or LSB is desired. You can measure the -20 dB points of the 3 KHz filter using the S-meter and a calibration signal and remember the appropriate setting of the BFO frequency control. Rough tuning of an SSB signal is done with the KCS knob, and fine tuning with the BFO PITCH knob.

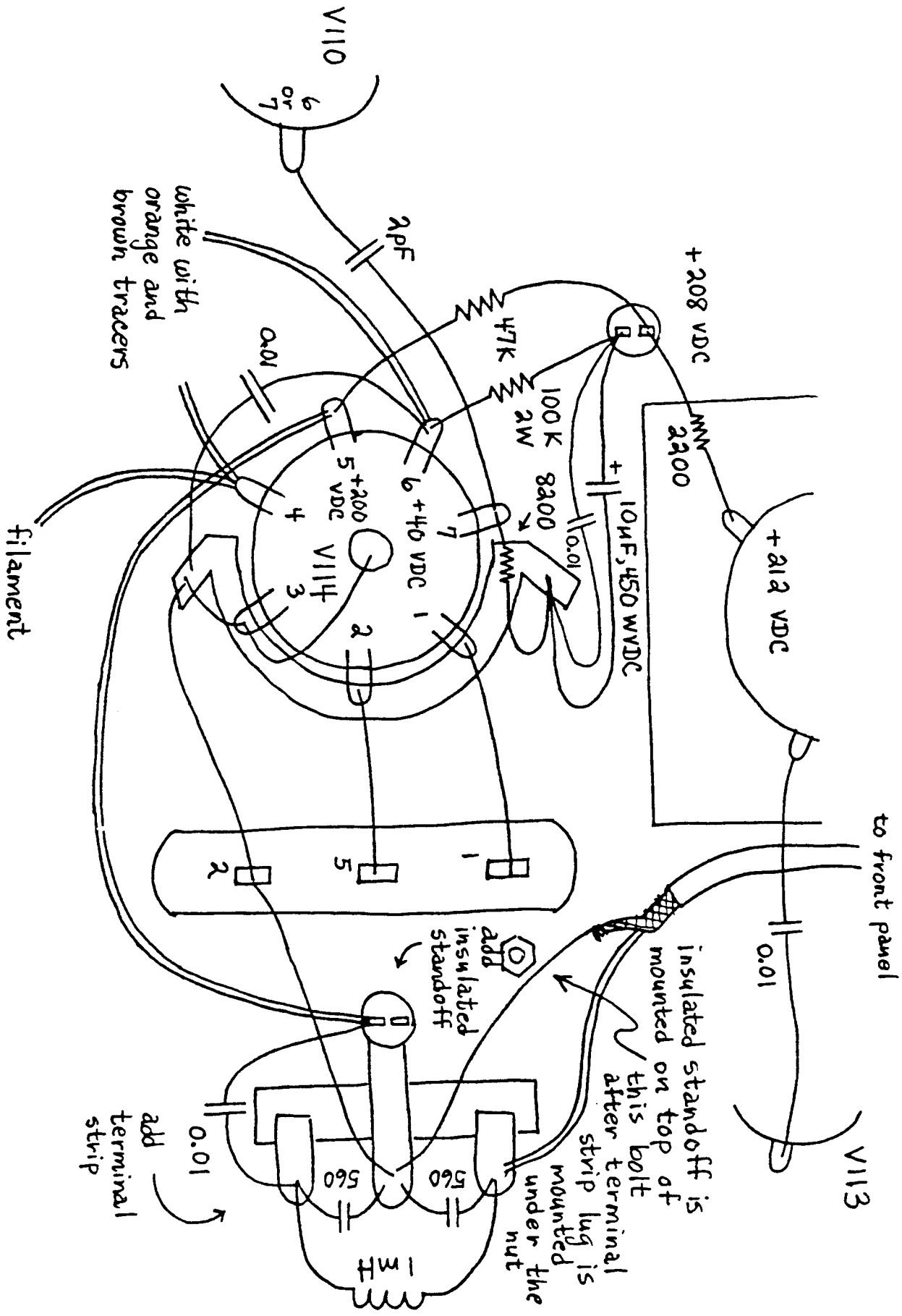


Fig. 5 — Product Detector Layout