

Souping the Super-Pro

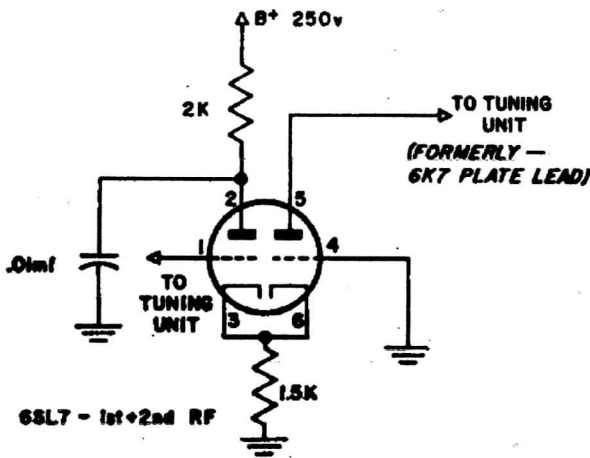


Fig. 1

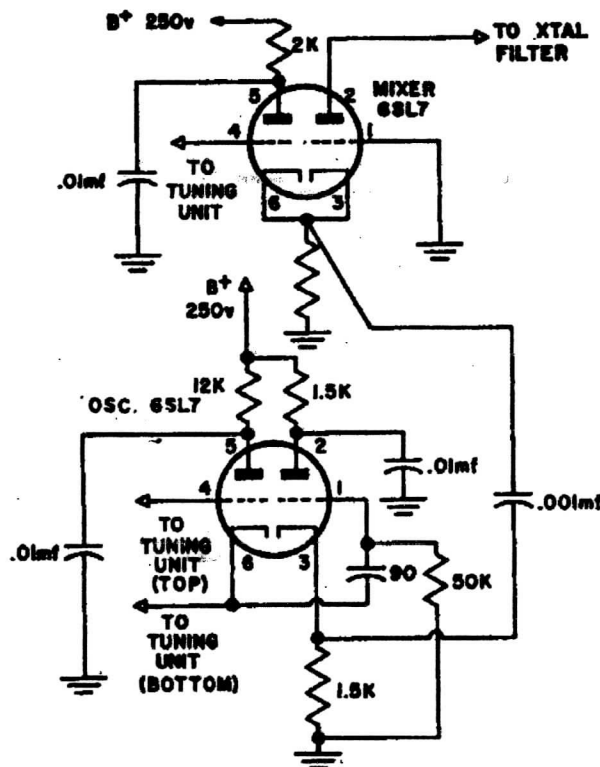


Fig. 2

Note: Missing wire added pin 5 to Blue in Fig. 3
See QST Feb 57, page 58

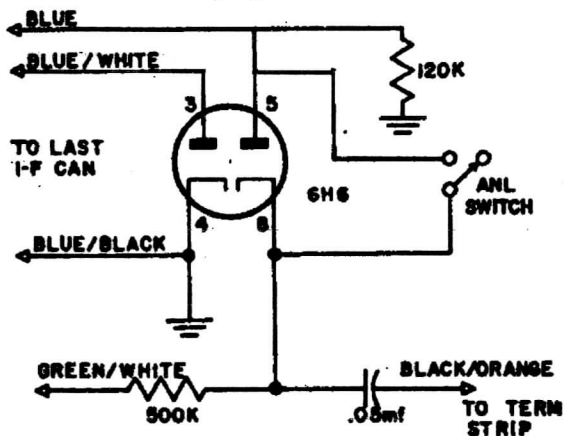


Fig. 3

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Dust off that surplus Hammarlund "Super-Pro!" Recently there has been a rash of articles concerning the advantages of grounded-grid amplifier conversions for ailing and noisy communications receivers. Inasmuch as these articles, while done in excellent form, do not cover the hot-rodding of the entire receiver, I'd like to attempt to correct this lack by releasing formerly "classified" data used by our firm in routine overhaul of surplus "Super-Pro's" (BC-794, 779, 1004, R-129/U's, etc). I hope that those readers who do this all-or-nothing revamp job appreciate the fact that we charge our customers the small fee of \$80.00 for the same work done in our factory, with guarantee, of course! (We retail these converted sets for around \$120.00.) Note also that this is not a learned discussion of grounded grids vs. pentodes, etc., this is PRACTICAL!

Although the method I'm outlining here seems like a king-size job, be of good cheer! You can do the job in about 12 man-hours if you're an average solder-slinger, only a little longer if you're out of practice or a duffer. The only *unusual* tools you'll need—if you're of a mind to do a really professional job, are a TV Alignment Generator, an Oscilloscope and a "Microvolter" for noise and gain measurements. You can't align the Xtal filter without the TV Generator and the 'scope.

Before hotting up the side cutters *read this article all the way through*, then, lay in a good supply of 0.05 mfd and 0.01 mfd oil-filled bypass capacitors (about a dozen of each), a half-dozen of 1.5 k Ω , 1/2 watt carbon resistors, a 350 Ω , 2 watt, a couple of 500 k Ω , 1/2 watt's, a 120k Ω ditto and a couple 0.001 mfd 600 volt mica's. You'll need some rubber grommets for stuffing into 1/4" holes, say 6, some 6 feet of high-class hookup wire and some tubes. Get 4 each 6SL7's, 1 each 6AC7 and 6SG7 (yes, no miniature tubes!).

Flex those biceps and lay the set on its back!

after removing the 6N7, the two rf 6K7's, the 6L7 noise gen—oops, sorry, I meant mixer! Also delete the 6J7 oscillator, the last i.f. 6SK7 and the 6SK7 avc amplifier.

Throw away that 6L7 boy! Also discard the 6N7. Place the other bottles on the shelf for spares (if they're any good). Insert the 6AC7 in place of the last i.f. 6SK7, ditto the 6SG7 in place of the other 6SK7 in the avc amp socket.

Now, ready to go to work? Will properly made out and signed? OK, prop this copy of "CQ" where you can see it clearly and get with it!

Remove all components from the two rf tube sockets, the mixer and oscillator sockets. Careful, don't cut those tuner plate leads short! Keep the 50 k Ω mixer grid resistor and the 90 mmfd osc-mixer coupling capacitor. Keep also 2 k Ω screen decoupling resistors from the 6K7 sockets.

Prick-punch and drill a 1/4" hole through chassis near pin 1 of both the rf tube sockets. Deburr the holes and install rubber grommets. Do likewise the alongside pin 4 of both the mixer and oscillator tube sockets. Refer to the schematic and wire up the four stages. Do not connect the grid leads marked "To Tuning Unit" at this time—the set's too heavy to flop over easily! Where decoupling capacitors are shown, use the fresh oil-filled units you just shelled out that hard cash for. After all, the last of the BC type Super Pro's came off the production line about 10 years ago and something's pound to give!

Comes now the confusing part of the job. Go slow and refer to the figure before making the following changes since you might possibly go astray. You'll notice that the 6H6 avc diode has a three volt external bias applied through the bias bleeder on Strip E-24. Now, referring to the figure, remove the 2 bias lines from terminal 9 of the strip. Swing these two lines over to any handy grounding lug and solder. Remove the 0.05 mfd bypass capacitor from this same terminal and install a fresh one. While you're still at this spot, remove the avc-feed lines for the 1st rf stage and the mixer bias return line from their respective terminals and ground also. This last step operates the 1st if and the mixer self-biased and "wide-open." Don't worry, it works!

Remove the 0.02 mfd capacitor from term. of E-24 and pin 5 of the 6J5 1st af tube socket. Replace with a piece of hookup wire. Remove the 500 k Ω grid resistor while you're at it and open the ground lead going to pin 8 of the 6J5 and insert a new 1.5 k Ω resistor. Now remove the 750 Ω 6F6 output stage cathode resistor and replace with the new 350 Ω , 2 watt resistor. Clip out the jumpers connecting the screens and plates (triode connected) of the output 6F6's. Lay in a new one from these two screens to term. 4 of Strip E23. You have just gained 10 watts of audio!

Now we really go ape! Sneak up on the 6N7

socket and—REMOVE ALL WIRING! (This following change was suggested by a Hammarlund engineer in "QST" and has been modified by this writer to a more workable arrangement.) Be careful not to cut short the leads coming out of the last i.f. can. Remove all components from the 6H6 2nd detector socket and from terminal strip E-21. Do not remove the black/orange audio line on pin four of the terminal strip. Do not remove the heater lines from term. 1 either. Remove all jumpers from pins 3-5 and 4-8 on the 6H6 socket. Proceed to rewire the 6H6 socket according to the diagram. Your good sense will dictate the parts layout. When this wiring is done you'll have an excellent series type ANL.

Hang on, there's still more!

Locate the wire that runs from terminal 1 of R-41 to term. 1 of Strip E-20. Unsolder this wire from R-41 and splice to length of wire long enough to reach and connect to terminal strip E-24, term. 9. Now solder in a 1.5 k Ω resistor from Strip E-20, term. 3 to any handy ground point.

Now, if you're still with me, raise the set onto (grunt!) it's right side. Remove the now unnecessary grid clips from the tuning unit grid lines and splice on some leads long enough to go the distance to the previously unwired grid pins of the rf, mixer and oscillator stages. Dress these leads well away from the chassis and side of tuning unit, allowing just enough slack to clear the 6SL7's when they're inserted in their sockets.

REVERSE the leads to the S meter! Remember the reverse English you removed from the avc diode?

Now c-a-r-c-f-u-l-l-y remove the can from the last i.f. xfmr. Remove the 100 k Ω resistor you find on the terminal board within. Replace with a 500 k Ω resistor. Replace all the paper bypass condensers with fresh oil-filled ones. Put a piece of heavy waxed paper inside the i.f. can to prevent shorts and reassemble. Do be careful now!

Next, carefully and tenderly perform the same condenser replacement operation on the avc i.f. can assembly, meanwhile being most careful to prevent shorts from occurring.

(Want to really do it up brown? Replace all the bypasses inside the Tuning Unit by removing the whole thing from the chassis and taking off the side and bottom plates . . . if you feel like a 100% overhaul job. Of course, you could do the job by fishing out and around a few coils but the dangers here are rife. I don't recommend that method.)

There is one more avc bypass capacitor which deserves replacement. Remove the side plate (first take off the panel bracket) of the xtal Filter and remove and replace the capacitor that you see. Leave this side plate off if you intend to sweep align the filter as you have access to the phasing control trimmer.

Now, while you still have the set on its

side, make a thorough check of your wiring. Seeing that it agrees with the schematic. You might also sweep out all the trash left over from your rewiring efforts.

Occasionally, after completely refurbishing your Super-Pro you will find the noise level has *gone up* rather than decreasing. This is due to very high leakage in the old wiring harness. The only cure is to strip out the old harness carefully and make up an entirely new one and rewire it into the set. We suggest you replace the harness on any set which is 3 or 4 digit serially numbered, just on general principals.

Everything in order, you hope? OK, fire it up, you're FINISHED!

If you made a noise measurement before you started this clambake, make the same kind of check again and compare your readings. You should have 50 to 80% *less* internal set noise! You might say noise is conspicuous by its absence.

You probably are not lucky enough to have an instruction book so follow these "condensed" alignment instructions. *Omit the Xtal Filter alignment if you don't have access to a FM or TV alignment generator and oscilloscope.* It won't make too much difference in the filter operation I hope.

Super Pro Alignment Instructions — IF and RF

1. Connect hot lead of Signal Generator to grid (pin 4) of mixer through 0.001 mfd capacitor. This prevents excessive loading of the mixer. Ground the other lead.

2. Set bandsread dial to 100, main dial to 2.5 mc, Xtal Filter switch to 3, avc on, anl off (this switch is now reversed), bfo off, Sensitivity maximum, Bandwidth to 3.

3. Tune signal generator slowly through the resonant peak of the Xtal Filter, 465 kc. You should find one point where the S meter really whops over. That should be it. However, the set may have been misaligned at some time. Advance the gain control and listen for the "ring" of the crystal and tune the Signal Generator for maximum S reading at the crystal "ringing" point. Back off the generator output to keep from wrapping the S meter pointer!

4. Switch filter out, peak *last* i.f. for maximum volume, then work forward, peaking all the other i.f.'s by S meter. If you have no FM or TV generator don't touch the top slug on the Xtal Filter box! Peak up only the bottom slug. You should also peak up the avc Amplifier trimmer. You'll get a drop in volume as you increase the resonance of this stage. Don't worry, this is a normal indication that the stage is operating properly.

5. Now set the bfo control knob so that shaft coupling set-screws face upwards or away from the chassis. Loosen the knob's set-screw and readjust pointer to coincide if it now doesn't. Turn off Signal Generator modulation,

zero-beat the bfo by ear—naturally you'll have to lay the set down to get at the trimmer.

6. Remove the AM Signal Generator and connect your FM or TV Alignment Generator to the antenna terminals. Connect the *oscillo* scope to the phono terminals on rear of set to obtain sweep frequency display. (Omit #6-7-8 if you have no TV generator.)

7. Tune Alignment Generator and *receiver* to mutually compatible frequency and switch in the Xtal Filter to "1." You should be able to observe the Xtal notch move about on the display if the filter has been aligned previously. If not, tune the top slug—formerly untouched—until the selectivity peak rises and another appears. You may have to give a gentle nudge to the trimmer on the phasing control, with the control set at "O" and readjust the slug for maximum gain. A properly peaked Xtal Filter will show a pronounced peak and null when the filter switch is set to step 5 and the phasing control is rotated.

8. You might check the bandpass of your set by cutting out the filter and rotating the bandwidth knob to 16. A fairly symmetrical curve should show if you've done the job right. Anyhow, this completes the i.f. alignment.

RF and Oscillator Alignment

1. Remove the TV generator and connect the AM signal generator to the antenna post. A 50 or 100 Ω resistor in series with the lead will aid in obtaining oscillator harmonics.

2. Connect a short antenna to the ungrounded antenna terminal and tune to pick up WWV's 15 or 10 mc signal. Tune Signal Generator to 2.5 mc and zerobeat the harmonic output with WWV. Leave the Signal Generator there and disconnect the pickup antenna. Switch on the Signal Generator modulation.

3. Tune receiver to 2.5 mc—leave the bandsread dial at 100—and peak up the appropriate slugs in the bottom of the tuning unit. Start with the oscillator and work to the rear of the set. Observe S-meter for maximum peak.

4. Swing the main tuning over to 5 mc adjust the trimmers, starting with the oscillator to maximum.

5. Return to 2.5 mc and repeat the tuning with the slugs. Go back to 5 mc and peak the trimmers again. Keep this up—two or three times—until you've wrung out all she'll give. Keep the Signal Generator output as low as possible and still get a reading of S-2 or 3.

6. Repeat this routine on the remaining bands. For details on tuning up the low frequency bands, well, do you listen much below 1.5 mc?

This completes the alignment. I suggest rotate R-41 gently fully clockwise to "zero" the S meter.

If you have ever aligned your set before you'll have noticed an unusual characteristic

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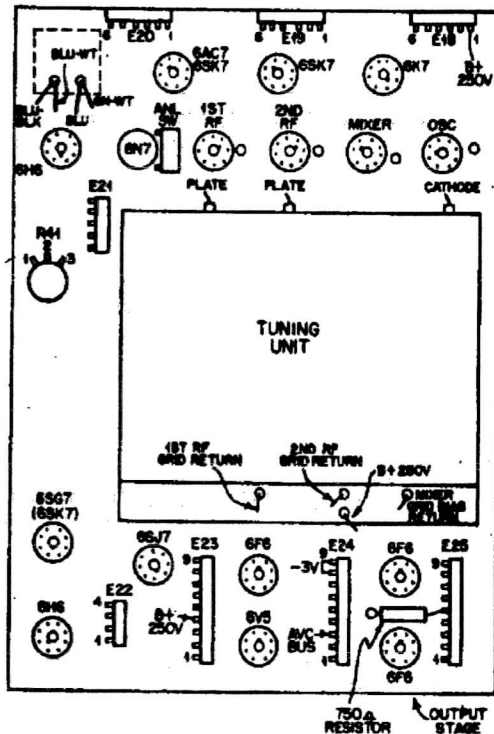
Super-Pro [*from page 32*]

of your refurbished Pro. You keep creeping up on the signal—then—plop! There it is. I believe this is due to the decreased loading on the rf stages and the increased AVC action due the 6SG7.

Anyhow, now you're really finished with the real work. Hang the set on the business end of the antenna lead and twiddle the band you habitually operate on. Notice any difference? You should be able to dig those background stations right out of the gravel now. We've noticed that sets done over this way give un-

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usually loud and clear signals sounding just like 40 db over S-9 when the S meter is just barely wiggling. Man, when he's so far down he's in the shot noise, it ain't your set, it's him! You'll notice now that the set doesn't have the usual "Driftmaster" characteristics. This is due the isolation afforded by the cathode follower between the oscillator and mixer. Frequently pulling on strong signals is also absent as is the considerable cross-modulation we'd been bothered with previously. You might say the old 6L7 was anything but a good mixer! The considerably better tone due the unbypassed 1.5 kΩ 6J5 cathode resistor is probably welcome. However, if the hopped up 6F6's should splatter on high levels, jump the remaining 0.001 mfd bypass across the output Xfmr primary. That should cure the bug.



If you're doing a "Christine Jorgensen" on a BC794 you might find that some filament chokes will help in eliminating losses at the high frequencies in the rf end of the set. Wind some chokes of No. 24 enameled wire on a 3/16" drill and stick 'em in the heater leads of all the front end tubes. Also, don't worry about long grid leads from the tuning unit. We've converted over 100 of these sets and haven't had a squawk yet! Remember, this is a practical, do-it-yourself story. For arguments which discuss the pros and cons, see the literature.

SSB fans will find the set now is excellent for their particular form of madness. Me—I like it too! See you in the looney bin . . . 73 . . . es much DX!