

# The Ultimate Conversion of the Super Pro Receiver

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*If you have an old Super-Pro or one of the many surplus versions of this "old faithful", up to \$100 to invest (depending on the stock in your junk-box), some spare evenings and week ends, a small kitchen table near a supply of hot coffee or cold bottles, you'll end up with a receiver to match the most expensive modern commercial jobs. These modifications could be applied to the HQ-120, HQ-129X and similar communication receivers*

This article has been prepared and dedicated to the many amateurs in the United States and other countries throughout the world who still own and use, or have access to, that grand old behemoth of receivers, the Super Pro. Even though it is many years old, this receiver has all of the basic prerequisites of a modern receiver. The battleship construction lends itself admirably to rigidity and stability and the major components are of a superb quality found only in the most expensive present day receivers. The desire of most radio amateurs to design, create and to strive constantly to improve their equipment has contributed to most of the present day advancements in h.f., v.h.f. and u.h.f. communication developments. My desire to do something constructive was brought about not only by the two articles by L. E. Geisler,<sup>1</sup> and Comdr. Paul H. Lee,<sup>2</sup> but also due to the theft of a newly completed Mohawk RX 1 receiver from my (locked) automobile one very rainy night. However through the offices of a very good friend, I was able to obtain a BC-779 in mint condition.

In planning for a major modification of this receiver, hours of drawing and redrawing sketches, and rereading the previous articles on this unit, were required. I had already completed an earlier modification on one Pro receiver patterned after the two articles, combining the best features of each, plus some ideas of my own. Armed with the experience gained and many new ideas, I was ready to begin planning for the final modification.

<sup>1</sup>Geisler, L. E., "Souping The Super-Pro", CQ, Dec., 1957, p. 30

<sup>2</sup>Lee, Comdr. P., "Save Your Super-Pro For SSB", CQ, Sept., 1958, p. 52

In the following modification it should be pointed out that the changes are equally applicable to the other models of the Super Pro, such as BC-779, BC-1004, R-129/U, SP-200, SP-210, SP-400 and others of this series. And with a bit of planning and ingenuity these changes can be used with slight variations for the modernization of the HQ-120, HQ-129X and other similar superheterodyne receivers. It is therefore suggested that the following changes be accomplished one at a time in the order given.

1—The construction of a new audio system and squelch system plus a self contained power supply using the new silicon power diodes, all contributing to the conservation of space, a tremendous reduction of radiated heat and a long trouble free life.

2—An improved product detector and beat frequency oscillator which is voltage regulated.

3—The rebuilding of the entire r.f. section, incorporation of a new cascode 1st r.f. amplifier, grounded grid 2nd r.f. amplifier and twin triode tubes in the mixer and oscillator stages, with voltage regulation.

4—An antenna trimmer capacitor, i.f. gain control and crystal calibrator switch installation.

5—Infinite impedance second detector, audio and noise limiter stages.

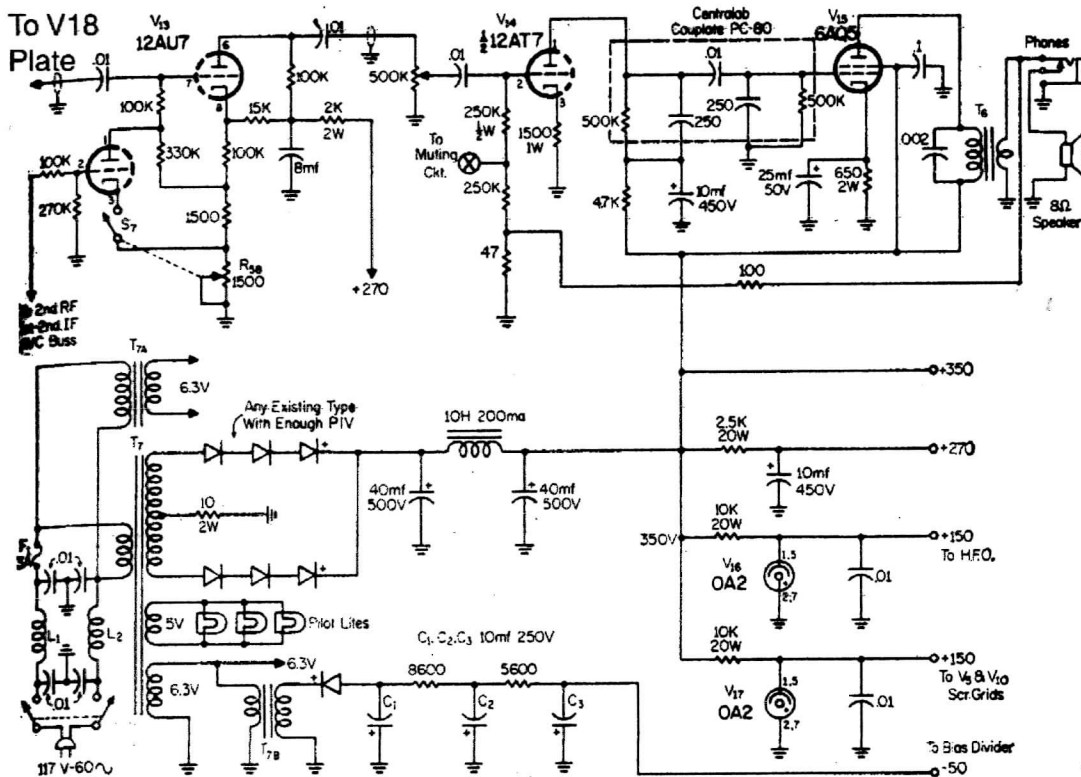
6—A 100 kilocycle crystal calibrator.

7—A "T" notch filter.

8—A crystal controlled converter for the series of receivers which do not cover the 10 and 15 meter bands.

9—Other minor items include the installation of an antenna coaxial chassis connection, auxiliary a.c. outlet and fuse holder.

The manner in which the modifications are



T<sub>6</sub>—Universal Output transformer 8,500 ohms to 8 ohms, 5W  
T<sub>7</sub>—Power transformer—See text

T<sub>7a</sub>—117v to 6.3 v.a.c. @ 6 amperes—See text  
T<sub>7b</sub>—117v to 6.3 v.a.c.—See text  
L<sub>1</sub>-L<sub>2</sub>—20t, #18E, 1/4 diam. close wound.

Fig. 1—Power supply, audio amplifier and squelch circuit. Regulated outputs are provided for the h.f.o. and i.f. screen grids. The 10 ohm resistor in the hv winding center tap is for surge limiting.

made will naturally be left to the discretion of the owner. However, the steps listed here facilitate those steps deemed most desirable. For example, the completion of the power and bias supply, and the audio system and associated circuitry in order to have an operating receiver before beginning other modifications. Precautions must be taken in the wiring of the new r.f., oscillator and mixer stages. Careful orientation of the new 9 pin miniature tube sockets at the time of their installation is important. The other stages were rewired in accordance with good wiring procedures; leads rigid, short and as direct as possible. Use a wiring harness for the major portion of those leads carrying the miscellaneous d.c. voltages. All power leads, as well as all audio leads, were run in shielded wire. The new filament transformer, located in the center rear, was covered with a heavy copper hysteresis shield to prevent 60 cycle hum from being introduced into the antenna circuit.

### Suggestions

It is recommended that the newcomer or the inexperienced amateur proceed slowly.

Study each circuit and modification before going ahead.

Do only one modification at a time and tag leads which will be used later. This method will save you many hours of trouble shooting to find

mistakes that are inevitable, should you attempt to make all the changes at once.

In order to fully understand all that is to take place, it is highly recommended that the original schematic diagram be on hand and it should be checked frequently. The two previously mentioned articles should be read and their contents thoroughly digested. All of these recommendations will be used with some modifications in order to improve our receiver, and it is extremely necessary that they be followed and completely understood.

When completed, the receiver is self contained, including the new, miniature power supply. It has all of the modifications deemed necessary for present day band conditions. It will do an admirable job of receiving a.m., c.w. and s.s.b. in the crowded amateur bands and can be surpassed only by receivers costing many times more than the cost of this modification.

### Power Supply and Sub Chassis Construction

The first step is without a doubt the most difficult, in as much as the new audio system and power supply components have to fit into the same space the audio system alone had previously occupied. The new circuit is shown in fig. 1.

To accomplish our first major objective we begin by removing the entire audio system, in-



The filament windings on the replacements are not adequate and must be supplemented by a separate filament transformer ( $T_{7a}$ ) with a rating of 6 amperes. This is the transformer shown in the rear of the underside view of the chassis. It has been wrapped in copper to help reduce the possible 60 cycle radiation into the antenna circuit.

Now select a sheet of aluminum large enough to cover the remaining hole in the chassis. This will be the sub chassis containing six miniature sockets, three 9 pin and three 7 pin miniatures. These are for the two audio stages, squelch stage, 2 voltage regulator tubes (0A2) and 1 spare 9 pin miniature for possible future use. Drill the necessary holes for mounting all of the sockets and tie point terminals and wire up all of the audio, squelch and the voltage regulator stages before securing the sub chassis to the regular chassis. Allow plenty of lead length for connecting of grounds, filament and B plus voltages, as they can be cut to the desired length later. The sub chassis is then secured to the main chassis by six #6 quarter-inch long self-tapping sheet metal screws.

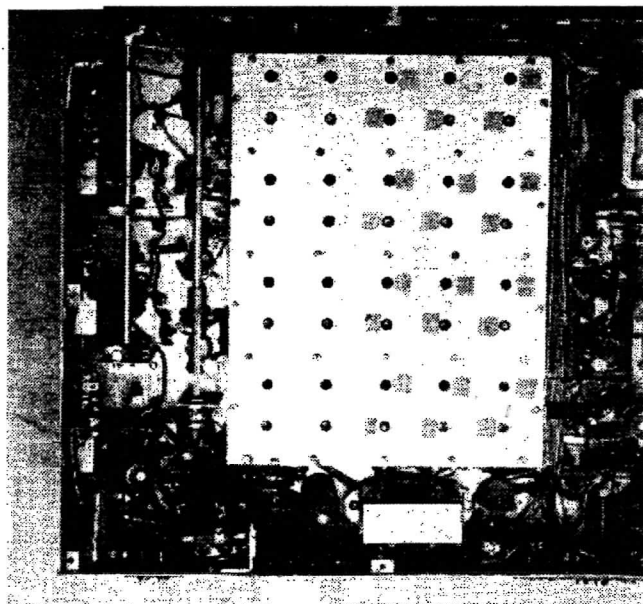
We can now mount our filter choke on the inside edge of our main chassis. The dual section 40 mf filter capacitor can also be mounted securely to the side of the chassis. The power diodes are mounted on a small piece of micalex or other good insulating material, and the whole assembly is mounted on stand-off bushings on the side of the chassis. Wire up the rectifiers, power transformer and filter circuit and install the line filters and fuse holder. Now wire in the new power on-off switch and the power supply may be tested. Voltage will be quite high without a load, so I suggest a 15K 20 watt resistor be connected across the output filter during the voltage measurements.

We are now ready to complete the wiring of the audio section. Finish wiring the two 0A2 voltage regulators. The 10K 20 watt resistors can be mounted conveniently above the back of the main chassis. The squelch circuit can also be wired at this time, if desired.

The squelch control potentiometer and its on-off switch are now mounted in place of the old SEND-RECEIVE SWITCH. Here, again, to avoid any possible chance of hum pick up, all audio leads are run in shielded wire. You are now ready to check out the receiver with the new audio system and the new power supply. If you haven't goofed somewhere it should take off and operate as before.

### Product Detector

The next step is to install the product detector and modify  $T_5$ . Remove the 6SJ7 b.f.o. tube and its octal socket. Unsolder the leads from the socket as they aren't long enough to begin with. Substitution of a 7 pin miniature tube socket in place of the octal socket is accomplished by using either a small square sheet of aluminum or one of the Mallory metal mounting wafers used for



The bottom view shows the location of the auxiliary filament transformer in the rear center of the chassis. To the left are the 2 ten watt resistors used in conjunction with 0A2 regulators; and to the extreme right is the line filter mounted on standoffs. On the right hand lip of the chassis is the output transformer and towards the front, the filter choke.

their can type electrolytic capacitors. They come in three sizes and are very well suited for adapting small sockets to large holes formerly occupied by octal sockets. The MP-4 will accommodate both 7 and 9 pin miniature tube sockets by merely using a  $\frac{1}{2}$ " or  $\frac{3}{4}$ " socket punch to enlarge the existing hole. The socket can be soldered directly to the wafer *after* it has been correctly oriented for minimum lead length. This not only applies to the product detector tube, but to all other stages, particularly the new front end of the receiver. In most cases the original mounting holes in the chassis can be re-used if you position correctly before soldering.

The shield can on  $T_5$  can now be removed in order to gain access to  $C_{40}$ , the original plate voltage blocking capacitor, and to remove it entirely from the circuit in order to provide a d.c. return for the cathode of the 6BE6 product detector. However, this connection does not go directly to ground. Remove this lead from its lug on the terminal board of the transformer and add a new lead about 12" long. This lead will connect to the top of  $R_{37}$ , 500 ohm pot which we can now mount conveniently on a clear space on the rear lip of the chassis. Re-assemble the transformer, taking care not to allow any internal shorts to exist. Refer to the schematic of  $V_{10}$  in fig. 3 and wire this stage.

### R.F. and Oscillator Section

The r.f. section of the receiver has been modernized to accommodate modern miniature tubes. The high frequency oscillator and its cathode follower ( $V_3$  in fig. 4) are fed from the voltage regulated 150 volt line of  $V_{16}$ .

A 3 mmf negative temperature coefficient capacitor is placed across the oscillator tank cir-



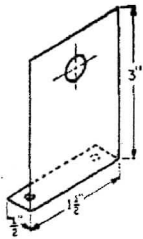


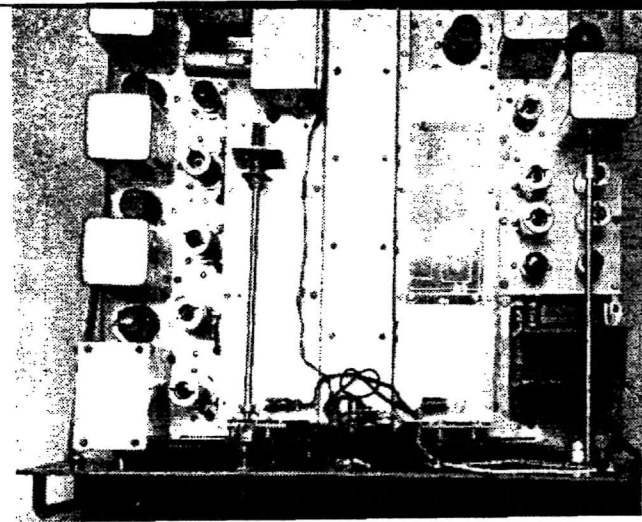
Fig. 5—Mounting bracket for the antenna trimmer.

rarily and make a pencil mark directly over the connection. Drill a  $\frac{1}{4}$ " hole and insert a small rubber grommet. Make a right angle bracket as shown in fig. 5. Use a piece of scrap aluminum,  $3" \times 1\frac{1}{2}" \times 1\frac{1}{2}"$ . Drill two holes for mounting, using a number 31 drill. Drill one  $\frac{3}{8}"$  hole for mounting the variable 35mmf antenna tuning capacitor. Mount the bracket on the cover, using  $\frac{1}{4}"$  4-40 machine screws, nuts and lock washers. Make sure the top surface of the tuning unit has been scraped clean of the coating of moisture fungus proofing. Now mount the variable on the bracket and replace cover and all of the screws removed. You can now replace the front panel after everything has been assembled. Install a flexible coupling between the antenna trimmer and the  $\frac{1}{4}"$  brass tuning shaft. Install the panel bushing and the second short piece of  $\frac{1}{4}"$  brass shaft. Connect the two brass rods with a  $\frac{1}{4}"$  universal coupling. A second coupling may be used as a stop and mounted directly behind the panel. Install the knob and you have an antenna tuning capacitor. The 1st r.f. coils must be modified to accommodate this new capacitor but we will leave this to be done in a later step.

### Infinite Impedance 2nd Detector, Audio and Noise Limiter

Our next operation is the rewiring of the old 6H6 diode 2nd detector and noise limiter circuit to an infinite impedance detector and first audio. Remove the late i.f. transformer ( $T_1$ ) from the chassis and take off the shield can. Remove all of the components on the mounting board except the small 5.5 mmf capacitor, the variable capacitor and the i.f. coil. Connect as indicated in fig. 3. You will now have five leads coming from the i.f. unit. If the original leads are too short this is a good time to install longer ones. Replace the 6H6 detector with a 6SN7 or 12AU7, and wire as shown. One triode section is our new infinite impedance 2nd detector, and the other half the new first audio amplifier. Install the auxiliary volume control in the rear of the chassis along side, or near to, the 500 ohm pot. At the same time remove the meter zeroing pot,  $R_{41}$ , and install it on the rear lip near the other two. These controls, once set, need not be touched again.

We also use a 6SN7 or 12AU7 in the noise limiter in place of the 6N7. Wire the socket as shown in fig. 3. This *must* be done prior to installing the 1 megohm variable threshold pot and the on-off switch. Next, remove the old ANL switch and shaft. Replace it with the 1 meg pot. Install a  $\frac{1}{4}"$  shaft coupling on the arm of the pot. Cut off enough of the old shaft so that the pointer knob will clear the panel by  $\frac{1}{8}"$ .



Top view showing the new miniature tubes in the front end to the left of the tuning unit. They are from front to back, 12AX7, h.f. oscillator, 12AX7 mixer, 6BK7 2nd r.f., 6922 1st r.f., 12AU7 a.n.l. To the rear of the 12AU7 is the old 6H6,  $V_8$ . The 6H6 is replaced by a 12AU7 or 6SN7 and is the new a.m. detector and first audio. This modification was not yet made when the photos were taken. The power transformer may be seen at the lower right mounted low enough to clear the b.f.o. shaft. Behind the power transformer is the audio sub-chassis with the left row of tubes (from front to rear) being, 12AU7 audio, 12AX7 squelch and spare socket. The right row is 6AQ5 output, 0A2 and 0A2. To the rear of the sub-chassis is the new product detector  $V_{10}$ , 6BE6. The new antenna trimmer may be seen mounted on the left side of the tuning unit. To the rear of the capacitor is the crystal calibrator.

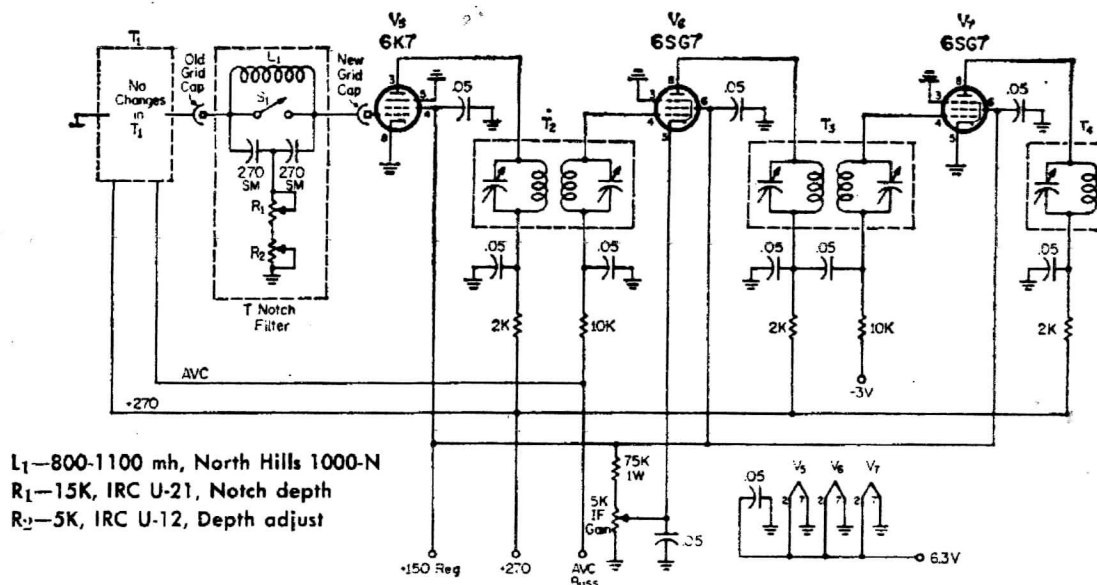
We now have a new noise limiter which really works, plus a new infinite impedance 2nd detector. This circuit will have to be realigned, and after completion it will be found that the i.f. selectivity has been improved considerably because the detector does not load the secondary winding of the last i.f. transformer,  $T_1$ . We no longer need a diode detector: it is a mystery why one was ever used.

We use a diode,  $V_{12}$ , to provide our a.v.c. voltage. Make sure the a.v.c. switch is wired correctly. Replace  $R_{19}$ , (a 1 or 2 megohm resistor) with a 10 megohm resistor. Check and make sure your bias voltages are correct, *i.e.*,  $-3$  volts and  $-50$  volts. Be sure and ground the unused contact on the AVC ON-OFF switch.

A 6AC7 is substituted for  $V_{11}$ , a 6SK7, providing additional gain in the a.v.c. amplifier stage. No other modifications are made at this socket.

### 100 KC Crystal Calibrator

You can next assemble, build or buy, one of the many crystal calibrator units now sold by several manufacturers. It can be placed conveniently close to the antenna trimmer capacitor by mounting the unit on a small sheet of aluminum slightly longer than the calibrator base. The aluminum bracket is drilled so that the holes



L<sub>1</sub>—800-1100 mh, North Hills 1000-N  
 R<sub>1</sub>—15K, IRC U-21, Notch depth  
 R<sub>2</sub>—5K, IRC U-12, Depth adjust

Fig. 6—There are no changes in the i.f. section other than the addition of the new 5K i.f. gain control. The "T Notch" filter shown between T<sub>1</sub> and V<sub>5</sub> is optional and may be installed if desired. Increased gain may be had by substituting 6SG7's for the 6SK7's V<sub>6</sub> and V<sub>7</sub>.

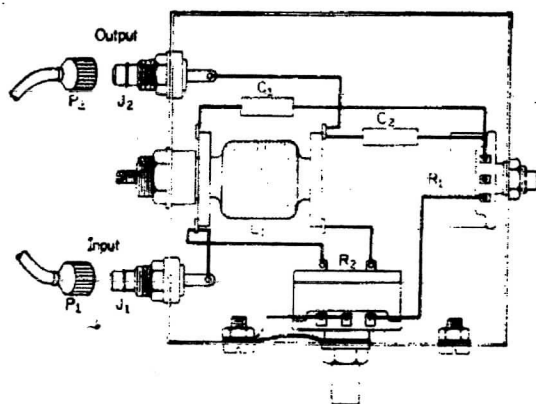


Fig. 7—Pictorial of the "T Notch" filter layout and wiring.

match those of the two holes on the left rear of the r.f. tuning unit. The two 4-40 binder head screws should hold the unit securely in place. A small socket is installed in the hole formerly used by the tuning meter pot. The hole may be enlarged to accommodate the miniature socket, if necessary. The one used in our case was an Amphenol miniature hexagon, series 126, 4 pin, cat. no. 28J740. It requires a  $\frac{3}{4}$ " diameter hole. Connect B plus, B— and 6.3 v.a.c. to the socket. B plus 150 to 250 volts is wired through the CALIBRATOR ON-OFF SWITCH SW<sub>6</sub>. A small three conductor cable made of hookup wire and a matching 4 connector plug is connected to the calibrator unit. This switch now applies B plus to the calibrator unit. The calibrator output wire is capacity coupled to the antenna trimmer by wrapping 2 turns around the lead coming through the grommet.

### "T" Notch Filter

The "T" notch filter was installed after the photographs were taken, however, it is presented for those who desire to build and install one in

their receiver. The entire unit is assembled in a small aluminum midget chassis, 2 $\frac{5}{8}$ " x 2 $\frac{3}{4}$ " x 1 $\frac{1}{4}$ " and mounted directly behind the panel, centered midway between the top of T<sub>1</sub> and the top of the panel. The circuit is shown in fig. 6 and layout in fig. 7. It is held in place by the 5000 ohm notch depth pot and two 8-32 machine screws. All of the components will mount inside of the chassis. The s.p.s.t. switch is also mounted on the notch depth pot. The variable inductance is a North Hills 1000-N. The capacitors are 270 mmf silver mica type. The small Switchcraft phono plug and jacks were used for connecting the unit in the circuit. The coil can be peaked with a signal generator once the set is functioning.

### Converter Stage

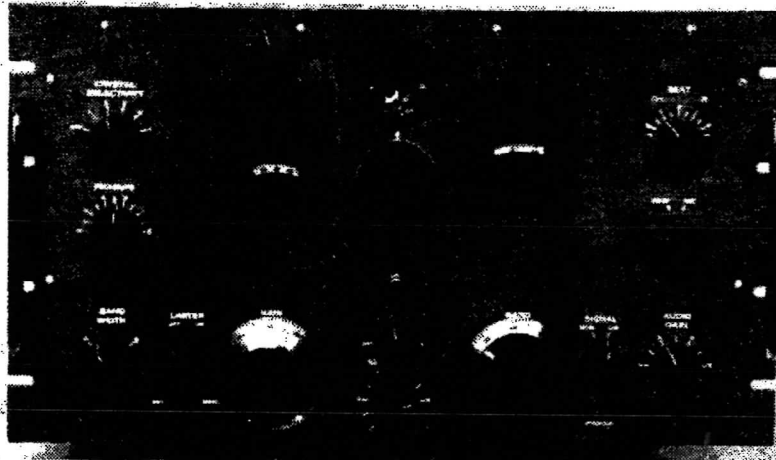
After all of the modifications were completed and the set was realigned and checked out, it was our desire to increase the frequency range of the receiver so that we could also enjoy the 10 and 15 meter bands. The h.f. converter was patterned, circuit wise, after the "Bonus 10-15 meter Converter," described in QST<sup>4</sup>. It was built with slight modifications, such as an r.f. gain control in the cathode of the r.f. amplifier, and an antenna transfer switch for switching the unit in or out of the antenna circuit when not in use.

### RF and IF Alignment

The i.f. transformer T<sub>4</sub> will require realignment because of the modifications to the 2nd detector stage. The secondary is not loaded nearly as much as before. The alignment can be accomplished quite easily, by using a signal generator tuned to the center of our i.f. frequency, 465 kc, or by tuning in a strong, steady carrier such as a local broadcast station and adjusting

<sup>4</sup>McCoy, L. G., "The 'Bonus' 21-Mc. Converter", QST, Oct., 1958, p. 33

The front view shows few changes. The control functions to the left of the main tuning dial are unchanged. Above the tuning dial is the antenna trimmer. Below the bandswitch is the 100 kc calibrator switch, the new i.f. gain control and the sensitivity control. The switch to the right of the bandspread knob is now the A.M.-S.S.B. mode selector while above the audio gain knob is the new squelch control. The notch filter, added after this photo was taken is located above the crystal selectivity switch.



the tuning capacitor for maximum reading on the S-meter. An attempt to realign the entire i.f. section is not advisable unless you have the instruction book, access to a f.m. or TV alignment generator and oscilloscope. However, if you are a purist and must try, follow the procedure as outlined by L. E. Geisler, in the December 1957 issue of *CQ*, on page 32.

### 1st RF Stage Coil Modification

After the set has been checked over and given its smoke test, all the mistakes and omissions corrected, and signals are pounding in very well, you are ready to proceed with the alignment of the r.f. section of the receiver. All that is necessary is a signal generator which can be tuned to 2.5 mc. Turn on the signal generator or frequency meter and let it warm up for several hours. This also applies to the receiver. While this is going on, there is still work to be done. Turn the receiver over on its left side. (uggghh). Remove the bottom plate from the r.f. coil housing assembly. Now locate the three h.f. 1st r.f. coils. They are along the rear wall. Remove the 6-32 machine screws holding the antenna coils. Pull the antenna coil away. The Faraday screen will also come away with the antenna coil exposing the 1st r.f. grid coil. Do one modification at a time. Starting with the 2.5 mc. coil, unsolder the wire which runs from the top of the coil, the end facing you. Pull the loose end through the two holes in the coil form. Remove three turns of wire from the coil and push the wire back through the two holes, pull tight, clean the enamel from the end of the wire and resolder. Apply some coil dope to the coil and reassemble the tuning unit. Proceed to the 5-10 mc r.f. coil assembly. Repeat the procedure, only this time remove only two turns. Then proceed to the 10-20 mc coil; this time remove only one turn but do not cut it off. Excess wire is now formed on the inside of the coil form in the shape of a circular loop as large as the inside diameter of the coil form. Poke the end of the remaining length of wire through one of the holes and resolder the wire to the original connection. You now have a circular turn of wire, which can be rotated, inside of this coil form. By rotating the turn of wire, you will be able to tune the 1st r.f. stage to

resonance when the antenna trimmer capacitor is set at mid range. Cement the coil in place and reassemble the r.f. unit. You will now have an antenna trimmer capacitor which will really peak each signal right on the nose. The capacitor will peak at mid range on all three bands.

If you have checked the performance of the receiver before making this modification, try it again and you will be amazed at the overall improvement. Before making this change, a signal from the signal generator was used as a reference signal. The generator frequency was set to the center of each of the three amateur bands, e.g., 75 meters: Set the receiver band switch to the 2.5 mc-5 mc band. Adjust the output frequency of the generator to 3.8 mc. Tune in the signal on the receiver and adjust the generator output or coupling so that the receiver signal as indicated by the S Meter reads S5. The modifications were then made, and after completing, the receiver was again tuned to the generator frequency. An increase of 3 to 4 S units was noted on all three bands. This has been the average improvement on all of the conversions which have been made. It certainly is a worthwhile improvement, well worth the short time required to make it.

### RF and Oscillator Alignment

In order to complete the alignment of the oscillator and the r.f. stages, it is suggested that the procedure outlined by L. E. Geisler be followed without deviation. Also it is imperative that the signal generator output frequency of 2.5 mc be rechecked against WWV each time, before proceeding to the next high band. We might add, that in our case, both the receiver and signal generator were left on overnight, before starting the calibration of the r.f. stages. If this procedure is followed, the receiver calibration will be as accurate as it is humanly possible to read the calibration of the dials. NOTE. It is especially important to set the newly installed antenna trimmer capacitor to its mid position before the final alignment of the first r.f. stages. Make sure all of the tube shields are in place.

### S Meter Circuit

The completed modifications on the a.v.c. detector  $V_{12}$  changes the circuit slightly, and now

$R_{41}$  acts as a sensitivity control across the meter. If a signal generator with a calibrated output is available, the meter adjustment can be set to correspond to the calibrations of the meter. Or if a suitable generator is not available, one may use a strong signal, such as a broadcast station or short wave station, to calibrate the meter; e.g., adjust the pot  $R_{41}$  until the meter just pins on an extremely strong signal. The meter will read 0 with no signal in.

### T<sub>5</sub> Tuning

After modifying the b.f.o. transformer  $T_5$ , it will be necessary to retune the transformer to the i.f. frequency. The modification on the coil connection changes the frequency slightly. It will be necessary to center the b.f.o. tuning capacitor and make sure the pointer is also in mid position. With an insulated screw driver adjust the variable padder capacitor  $C_{48}$  to exact zero beat with an incoming signal. Once this adjustment has been made it will be possible to receive c.w. and s.s.b. signals. All that remains for s.s.b. reception at its best is the proper setting of  $R_{57}$ . Tune in a good strong s.s.b. signal, free of interference, and slowly rotate the arm of  $R_{57}$  until the received signal reaches maximum volume and minimum distortion at the same setting or time.

### Muting Circuit

The muting circuit is extremely simple and quite adequate, utilizing the —22.5 volts for bias on the 1st r.f. stage and the 2nd audio amplifier stages. The applied increase in bias cuts off the plate current of the 1st r.f. amplifier, and 2nd audio stages. The relay terminals  $E_2$  were used and rewired for proper connection to our coaxial antenna Dow relay.

The complete modification took many evenings, and lots of hours of work, plus a couple of long week ends at the home of W2CLG. Most of the work was accomplished, however, on a small kitchen table in a Brooklyn apartment. Therefore, anyone having a good work bench, plus the normal amount of hand tools and necessary equipment, will find the project much easier. The entire cost of the receiver modification, including the h.f. converter, was just under \$100.00 and all can be accomplished for considerably less if there is a good supply of parts already on hand. Only the best of components were used. All disc type capacitors were the 600 volt rating. Other capacitors, such as filter capacitors and the large bypass capacitors, were either the molded type, or metal can type, with the highest possible working voltage. Multi-section filter capacitors were used wherever possible to conserve space.

This modification has been one of the most interesting, constructive and challenging projects undertaken, and once completed, you too will have a receiver which will stack up alongside the best of them. It is now a pleasure to operate on c.w.-a.m. or s.s.b. and the stability is excellent. Too, with the addition of the h.f. converter, we are now able to cover the high frequency bands. The addition of a crystal controlled converter

further adds to the stability of the h.f. bands. The signal to noise level has been greatly improved. On the 75 meter phone band, on a Sunday afternoon, we can now copy an S-1 signal Q-5. In addition to covering all the h.f. Amateur bands, we can also cover all of the commercial frequencies as well as the MARS frequencies. We hope you will enjoy your newly rejuvenated receiver for many years.

While you are working on your receiver, perhaps other improvements and modifications will come to mind. The front panel appearance has been changed very little. The main difference is the addition of the new controls. A new band set dial and band spread dial were added. These were the 2½" Crowe instrument dials calibrated 0-100 in 360°. They add to the appearance and help calibration. Duplicate pointer knobs were available on the surplus market.

### Credits

I would like to offer profound thanks to all those who have helped with suggestions and encouragement. Special thanks to Mr. Carol Freed for his very kind and able assistance and advice in the use of the 6922 Amperex tube used in the 1st r.f. stage, and suggestions which helped us in our simplified muting circuit. A special kind of thanks to Lew for his splendid critical comments, encouragement and suggestions, and for the use of the many pieces of test equipment and bench facilities required in the final completion, alignment and testing of the completed receiver (and also for the many cold bottles of nourishment during the day, and the hot coffee during the late hours).

To those of you I may have tempted, I offer you the best of luck. Many long hours of good listening and good hunting. May all of you make DXCC. See you all from Greenland! ■