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By utilizing existing holes, very little mechanical work is required on the front panel of the receiver.

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So I Bought a 348-Q

J. H. OWENS, W2FTW*

With some major surgery, that can nevertheless be handled by the average amateur, the performance of the 348-Q can be improved immeasurably.

YEP, I DUNNIT. On the recommendation of a certain editor of a certain radio magazine, I plunked down my dough and trudged home with 40 pounds of alleged radio receiver.

Sure, I've got a good radio receiver now, but the job of converting it was considerably more involved than what I had been lead to believe. The d.c. to a.c. changeover was easy enough—the printed instructions were complete, and they worked right off. The only change was to install a 10-μf, 50-volt electrolytic in the 6K6GT bias network directly across the .1-μf capacitor (63–2). This was done to reduce the hum picked up by the 6K6GT grid.

Then I got my first real look at what I had bought; a slightly used 348-Q having the following features:

1. Two stages of r.f. having questionable gain.
2. Three stages of wide band i.f. that let me hear too many stations at the same time on the crowded amateur bands.
3. A crystal filter that really suppressed signals, including the ones I wanted to hear.
4. An audio amplifier that delivered one watt of distorted power when the receiver was tuned to an overmodulated kilowatt next door.
5. A brightness control for the dial lamps (now ain't that wonderful!)
6. An audio volume control and r-f gain control on one shaft (a special feature for lazy hams!)
7. An unventilated cabinet that kept the set nice and warm so it wouldn't catch a cold.
8. Extra—one burned out antenna coil.

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As Grandma used to say, "There's no use crying over spilled milk," so I gritted my teeth, cursed a bit, rolled up my sleeves, and went to work.

I-F Channel Selectivity

Sharpening up the pass-band involves using surgery on the i-f transformers. However, the operations are minor, and local anaesthesia is all that is necessary. The only precaution is to pull the a-c plug, and this is good practice right along until you discover all the odd places where hot wires are concealed.

The first step is to remove the shield can from the first i-f transformer. Then take a piece of push-back wire about 5″ long, and wrap it twice around the coil form, halfway in between the primary and secondary coils. Twist the ends together, solder them, and snip off the left-over pieces. The effect of the two shorted turns between primary and secondary is somewhat the same as a metal shield. It reduces the degree of coupling and sharpens the response curve.

Now put back the shield can, and realign the transformer. Tune the receiver to a spot where there are no signals; turn up the gain until you can hear background noise; put the crystal filter "in," and adjust the tuning slugs for highest sensitivity, which is found at the point of loudest background noise.

Repeat this operation on the second i-f transformer and then finish up with the third i-f transformer. Then go over all of the tuning adjustments as a final check. Now try the receiver again on the 75 and

20-meter 'phone bands, and you will find that the selectivity is materially improved. Alas and alack, you may also find that you have lost a bit of sensitivity, but don't let this worry you. Most of the loss is located several kilocycles from the center of the response envelope, and this is beneficial. Furthermore, when you have completed the conversion, the receiver will have more gain than it had when you started.

The Crystal Filter

As a crystal filter, this stage is a disappointment. Due to the fact that there is no means of varying the crystal selectivity or the phasing, the results obtained are of little practical use for amateur communications. Therefore this stage is eliminated completely. All associated parts connected to the 2nd i.f. (6SK7) are removed. Some of these crystal stage components are used later for a more practical purpose.

After eliminating the 2nd i-f stage, it's necessary to couple the first i-f tube to the 2nd i-f transformer.

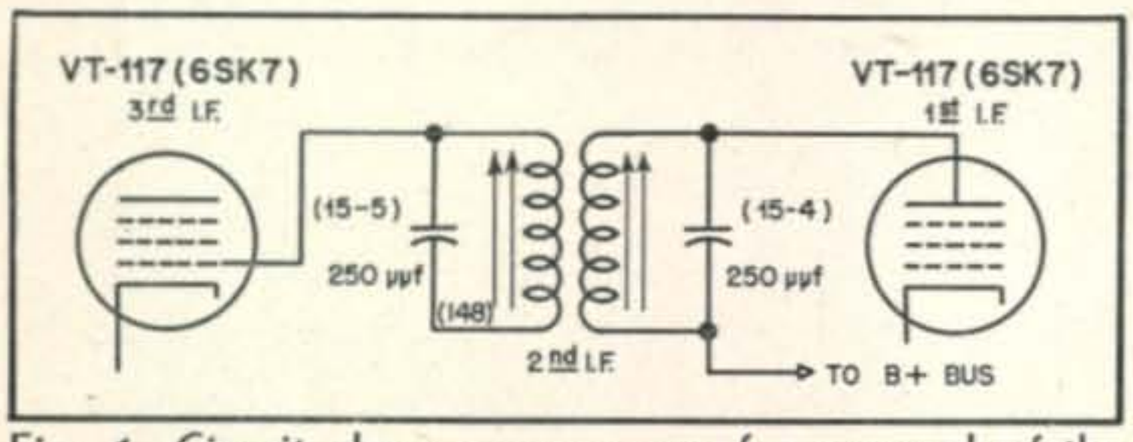

Fig. 1. Circuit changes necessary for removal of the crystal filter.

This is the simplest change made during conversion. Remove the 5000-ohm resistor (101–1) connected to the plate of the 1st i-f tube, and connect in its place the plate terminal of the 2nd i-f transformer.

The next step in the operation is to remove the crystal coil assembly, crystal switch, and the crystal intact. Then make sure the circuit is wired as shown in *Fig. 1*. Note that the 15,000-ohm resistor (99–1), the coil assembly (150), the 100-$\mu\mu$f coupling capacitor (34), the 35,000-ohm resistor (97–3) and the 5000-ohm resistor (101–2) have been removed.

After this change, realignment of the 1st and 2nd i-f transformers is necessary. At this point, again, don't be disappointed at the lack of receiver gain.

The Regenerative I-F Stage

The final i-f amplifier tube (VT-116) is made regenerative by soldering half-inch pieces of wire to its grid and plate socket terminals. When these wires are positioned about one-quarter inch apart, the tube will oscillate. The plan is to operate the tube below the oscillating level. By varying the degree of regeneration, the degree of selectivity and sensitivity can be controlled. When considerable regeneration is used, single-signal reception results.

The first step is to remove the VT-116 (6SJ7) and substitute the VT-117 (6SK7) from the crystal stage. A remote cutoff tube must be used because the sensitivity and regeneration are controlled by varying the grid bias. Now take the following steps:

1. Remove the connecting wire that goes from the cathode of the 6SK7 to the cathode of the VT-233 (6SR7). Ground the cathode of the 6SR7.

2. Remove the 6SR7 grid resistor (100,000-ohm) from the 6SK7 cathode and solder it to a ground point. Bypass the 6SK7 cathode to ground with a .1-μf capacitor at the socket.

Audio Volume Control (Second Detector 6SR7)

In order to get more audio, the following changes are made in the 2nd detector stage as shown in *Fig. 2*.

1. Disconnect the plate (red tracer) and grid (green tracer) leads of the c-w oscillator assembly from the 6SR7 2nd detector. Also disconnect the 35,000-ohm plate dropping resistor (97–1) from the plate socket pin. Leave its other end connected "as is" to the C.W. OSCILLATOR switch.

2. There is a 2-megohm resistor connected between the pin-5 diode and ground. Unsolder its ground end and run it over to the junction of the filter choke (155–B) and the 50-ohm resistor (108–2). This puts about 2½ volts of fixed bias on the diode and on the several grids in the a-v-c circuit.

3. Connect a 2-megohm resistor between the 6SR7 grid and the 2½-volt fixed bias point (see 2 above).

4. Connect a .01-μf capacitor between the arm of the volume control and the grid of the 6SR7 tube.

5. Install a 47,000-ohm, 1-watt resistor between the 6SR7 plate and the B+ terminal of the 3rd i-f transformer.

6. Connect the 1250-$\mu\mu$f 6K6GT grid coupling capacitor (25) to the 6SR7 plate.

With these changes the triode section of the 6SR7 is used as a 1st audio stage, which provides in itself a tremendous improvement in the over-all operation of the converted receiver.

The Beat Oscillator

Since the triode portion of the 6SR7 has been changed to the 1st audio, it is now necessary to make use of the eliminated 2nd i-f crystal stage for b.o. All wiring and parts associated with this stage were taken out with the exception of the filament wiring. This included the removal of wiring from the screen grid and cathode which were in parallel with the 1st i.f. (6SK7). The shell, cathode and suppressor are now connected together and tied to chassis ground. The plate and screen grid are tied together and go to the open end of the oscillator dropping resistor which was disconnected from the 6SR7 plate. It will be noticed that the plate voltage for the b.o. is obtained from the i-f screen grid in the original wiring. This circuit is retained but necessitates the wiring to be changed to the screen of the 1st i.f., thence to the same terminal on the fiber board on which the crystal filter coil was mounted. Wire the b.o. transformer to the new stage, putting the two wires on their respective lugs, green tracer to control grid and red tracer to plate. Black tracer can remain on the cathode of the 6SR7 as it is already grounded. Connect a 100,000-ohm ½-watt resistor (93–3) from grid to ground. This stage makes use of the 6SJ7 tube removed from the regenerative i.f.

Due to the fact the plate lug of the b.o. is close to the plate wire from the 1st i.f. (6SK7) to its respective transformer, enough capacity coupling will be found in most cases to give good c-w reception.

In any event it is not necessary to use more than one turn of pushback wire if extra coupling is used.

Delayed A. V. C. and Protective Bias

In the preceding instruction, the cathode of the 6SR7 was grounded, and fixed bias was put on its grid and on its a-v-c diode. Use was made of the source of negative voltage in the amount of 2.5 volts across the 50-ohm resistor (108–2) which provides bias for the number three grid in the VT-150 (6SA7) tube. The fixed bias on the a-v-c diode provides delayed a.v.c. because no current can flow through the diode until the peak voltage exceeds 2.5 volts. Therefore, very weak signals will receive full amplification because they will not actuate the biasing system.

Because the 2.5-volt delay bias appears on the grids of the two r-f amplifier tubes and the first and second i-f amplifier tubes, there is no need for additional protective cathode bias resistors (which reduce the over-all gain). Therefore, the 250-ohm r-f amplifier bias resistor (106) and the 400-ohm i-f amplifier bias resistor (113) should be removed from the circuit. The cathode bypass capacitors (65) .25 μf and (63–1) .1 μf can also be removed.

It is necessary to rewire the A.V.C.-M.V.C. switch at this point so that the negative 2.5 volts will appear on the tube grids when the switch is in the m-v-c position as well as the a-v-c position (see *Fig. 2*). In the a-v-c diode circuit are two resistors which form part of the filter network. The junction of the 300,000-ohm resistor (90) and the 15,000-ohm resistor (99–2) is connected to a terminal on the A.V.C.-M.V.C. switch. When the switch is in the m-v-c position, this terminal is grounded through a 100-ohm resistor (107–3). To keep protective bias on the tubes when operated with manual volume control, disconnect the 100-ohm resistor from ground and wire it to the negative 2.5-volt side of the 50-ohm resistor (108-2). Now the switch will short out all of the voltage developed by the a-v-c diode, and will also keep protective bias on the amplifier tubes.

Manual R-F Gain Control

Every good communications receiver should have a separate manual r-f gain control. This control is doubly important in a set that uses a regenerative i-f stage for variable selectivity. To illustrate the point, consider what is necessary for maximum selectivity. If the gain of the r-f and i-f amplifiers is reduced to a minimum, the major part of the receiver gain can be a function of the regenerative stage operating just below the point of oscillation where it will have a relatively narrow band width. Conversely, if broader band width reception is desired, the regenerative tube gain can be decreased and the i-f and r-f amplifier gain increased. Intermediate adjustment and balancing of the two will provide variable selectivity. Optimum signal-to-noise ratio will be at maximum r-f amplifier gain setting.

To install an r-f and i-f gain control, first remove the dial light dimming rheostat. It is no trick, and no loss either, to change the wiring for full voltage on the pilot lamps.

In the panel space left vacant by the dial lamp rheostat, install a 20,000-ohm wire-wound potentiometer. To one end of this pot, connect the cathode return leads from the two r-f tubes and the first i-f amplifier tube. Connect the arm to ground. Adjustment of the potentiometer will vary the negative grid voltage on the tubes and regulate their gain.

The manual r-f and i-f gain control should be wired so that the .25-μf capacitor (66) is connected between the hot end of the potentiometer and ground so as to eliminate any contact noise. Incidentally, this control will function when the panel switch is on m.v.c. or a.v.c.

The above described modification eliminates the function of the 20,000-ohm r-f section of the volume control (110) and the 80,000-ohm resistor (94–2) which was attached between it and the B supply line.

The Audio Volume Control

The changes so far described will allow the receiver to develop good room volume if the output transformer is properly matched to a loudspeaker. And this doesn't mean connecting the regular output transformer to the speaker voice coil. An intermediate matching transformer is necessary, but it can be almost any small output transformer. Try it on both the "LO" and "HI" positions, and make a

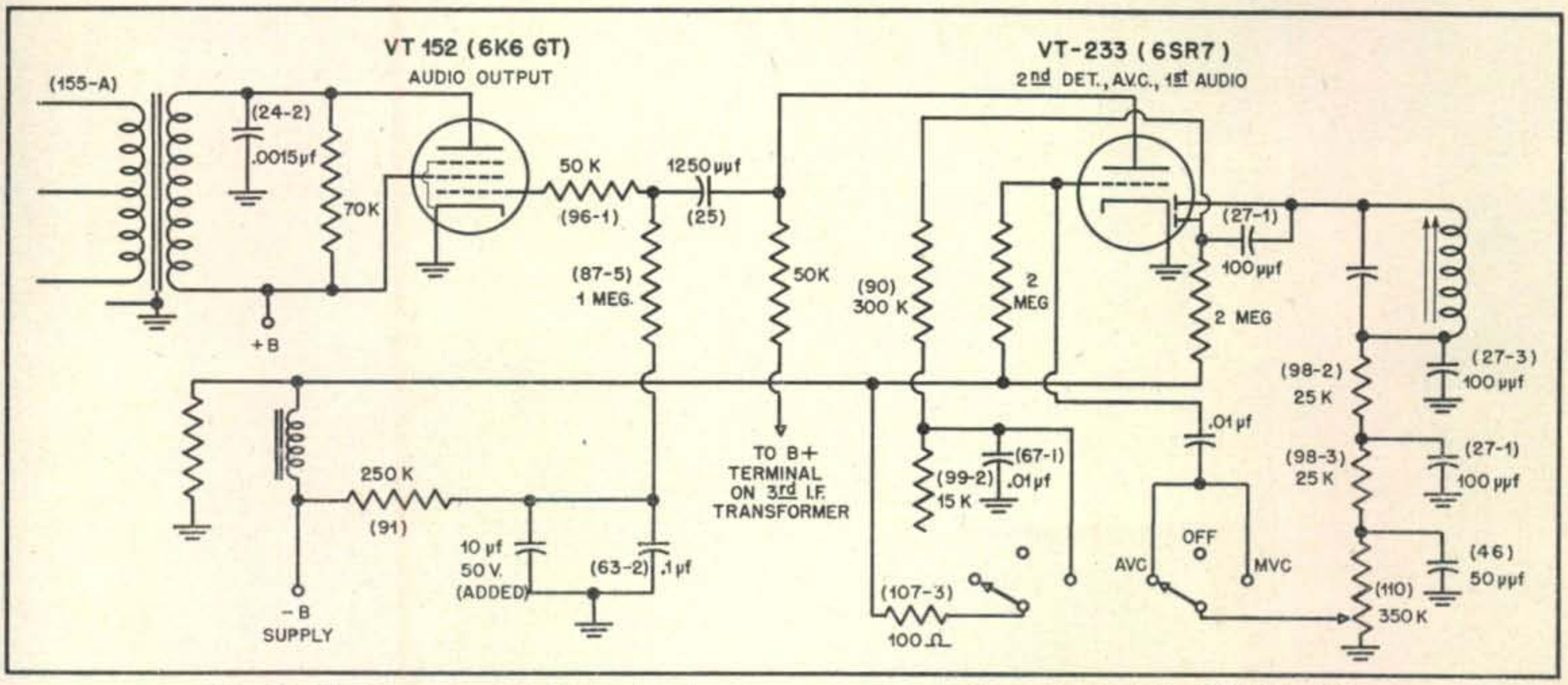

Fig. 2. Changes made in the circuit to increase the audio output of the BC 348-Q.

permanent connection to the one that gives the greatest output.

And while you're working on the audio end, make a useful change in the phone jacks. Eliminate one of them. Yes, take it out, and in its place put a toggle switch. Connect the switch in series with the power transformer primary.

Due to the high gain of the receiver at this time it is best to connect the remaining headphone jack to the LO position on the output transformer. There is more than enough volume in this position. The male plug located at the bottom rear of the receiver is removed and provides space for the new output transformer. A UTC 38 A fits nicely.

Upon removal of this plug rejoin the two white wires along with the bypass condenser, also the two brown tracer wires. Filament wiring can be taken out of the circuit.

A.V.C.-M.V.C. and the Screen Grids

The screen grid circuit controls to some extent the size of the r-f signal that the receiver will handle. For the widest control latitude, the screen grid voltage should have poor regulation. This can be accomplished by feeding the screen grids through a series resistor from the plate supply, without any bleeder resistors.

To start this modification, connect the first r-f tube as a pentode instead of a triode. To do this, simply disconnect its screen from its plate, and then wire it over in parallel with the screen of the second r-f amplifier tube. Next, remove the 100,000-ohm feeder resistor (93–4) and the one-megohm parallel bleeder resistor (87–3). On this same circuit is connected the wire that feeds the screen grids of the first and second i-f amplifier tubes. Follow this circuit through and remove the 35,000-ohm series resistor (97–2) and the one-megohm bleeder resistor (87–4). Now the first and second r-f and i-f amplifier tube screen grids are all connected in parallel, and they can all be fed through a single one-watt 30,000-ohm carbon resistor.

Two sections of the A.V.C.-M.V.C. switch were originally provided to handle the battery current to the dynamotor. This wiring is no longer necessary and should be removed. Then one of these switch sections can be wired to handle the screen grid voltage supply to the r-f and i-f amplifier tubes. If this is done properly, the A.V.C.-M.V.C switch will remove the screen grid voltage from the tubes when in the "off" position, which can be used for a "transmit" position in lieu of a send-receiver switch.

The First R-F Amplifier

Contrary to popular belief, connecting the first r-f amplifier as a pentode instead of a triode will not increase the gain. The reason is that the gain is related to the plate load impedance, which in this circuit is limited by the plate load, distributed capacity and 15,000-ohm plate resistor (99–3) and the transconductance. A tube triode connected has higher gm than the same tube pentode connected. Nevertheless, the change to pentode connections was made in a prior circuit modification because it improves the m-v-c and a-v-c action.

Perhaps the most effective improvement is one that will allow the antenna coil to be tuned with the

(*Continued on page 108*)

Emergency Capacitor

AN EMERGENCY high-voltage capacitor suitable for radio and electronic use may be made from two glass containers (such as tumblers, jars, or test tubes), one placed inside the other and both filled up to the same level with ordinary tap water. One bare wire lead is dipped into the water in one container, and a second similar lead is dipped into the water in the other container.

The water capacitor consists of two glass containers, one suspended inside the other, both filled with water. Bare wire leads immersed in the solution of each container act as the conductors.

Details of such a capacitor are shown in the accompanying photograph. The voltage that the capacitor will stand depends mainly upon the wall thickness of the inner container. The thicker the wall, the higher the breakdown voltage.

The capacitance of the unit depends upon the height of the water and the inside diameter of the inner container, as well as upon the wall thickness of the inner container and, to some extent, upon the grade of glass. For a high capacitance, use large jars, each filled within an inch of its top.

Following is the capacitance value obtained for the water capacitor shown in the photograph. This one, made by standing a 7/8"-diameter chemical test tube in a tall pickle jar and filling each with water to a height of 4", gave a measured capacitance of 300 $\mu\mu$f. A second unit, made by setting a small water glass inside a regular-sized tumbler and filling each with water to a height of 2½", gave a measured capacitance of 150 $\mu\mu$f. Voltage breakdown in each case is several thousand volts d.c.

The higher the water level, the larger the diameter of the inner container, and the thinner the wall of the latter, the higher will be the capacitance obtained. Larger containers will, of course, give higher capacitances. Also, several small water capacitors may be connected in parallel to obtain a high capacitance value. —*W1AY*

HEAVEN FOR HAMS

(from page 45)

off when it comes to owning his home and a bit of land.

Modern double-decker busses service all cities. The arts and sciences get their full play of interest and development. Its wealth of diamonds and gold make South Africa one of the few stable countries in this troubled postwar world.

◆

ZS2AG and Pal.

◆

Sick of this terrific W competition, fellows? If so, all you need is 200 South African pounds, a promise of a job, and a little guts to settle in a lovely land where those hard to get Asians are a reality rather than a dream. Why not see your nearest South African consulate now?

SO I BOUGHT A 348-Q

(from page 28)

particular antenna being used. This means adding an antenna trimmer condenser in the same manner it is used on several popular communications receivers. But it takes a lot of nerve to make this change, because some plates must be removed from the antenna coil section of the main gang tuning condenser.

The plan is to install a 100-$\mu\mu$f midget variable condenser in parallel with the 19-plate antenna condenser (1-A). Of course, the antenna condenser must be made smaller if a manual trimmer is to be used in parallel with it. Here's how.

Cut a hole in the front panel exactly 2" to the right of the r-f gain control (the position of the old dial lamp rheostat). In this space, which is directly in front of the first r-f stage, install the 100-$\mu\mu$f midget variable condenser. Connect the stator section to the same terminal to which is connected the stator section of the gang condenser (1-A).

Now brace yourself, take a deep breath, and go to work on the variable condenser. All sections have 13 plates except the antenna section which has 19. Pull out two of the rotor plates—I took out three without ill effects (upon the receiver)—but two will

let the newly installed trimmer tune the antenna coil.

In its final form the 348Q acts more like a narrow-band amateur communications receiver, and less like the broad-band aircraft receiver it was designed to be. An advertising man might describe it as having such desirable features as 2 r-f stages, high image ratio, single-signal selectivity, variable b.f.o., 5 watts of audio, antenna trimmer, self-contained power supply, vernier tuning, illuminated dial, separate a-f and i-f gain controls, manual and automatic volume control, transmit or standby switch, and phone jack.

This conversion was tested on three receivers and was found to be excellent. It corrects the two main deficiencies of the receiver, poor selectivity and insufficient audio. It still does not have an "S" meter, but S meters don't agree anyway, and in the final analysis it's not the position of a needle pointer that counts, but the ability of your ear to extract intelligence from the QRM serenades that identify the crowded amateur bands. It should be pointed out that the modifications described are equally well applied to the BC-348J and BC-348N.

SCRATCHI

(*from page 10*)

it for raleroad companies. Itchi are settling this by locking shack door and hiding key in neer-by cacktus. He saying that all this are causing big fuss, and partys concerned are hotter than #24 wire used as feeder line for kw.

But big trubbles come when I are finding that fence around Itchi's ranch are connected to other fences, so r-f is traveling all around this part of Arizona. Cattle what are coming in contack with fence are burning off sum hide. This are natchurally causing confusion as cattle brands are getting messed up and cattle are getting more than one brand. Itchi are saying with sly smile that this is a shocking bisness but I are not in my usual humor and are not appreciating funnybisness. Part of the posse that is looking for Scratchi are rounding up cattles and trying to figure out which are rite brand and which are Scratchi brand dew to r.f.

Itchi are just running up and showing me letter we are just receiving from telefone companies. They are inclosing itemized bill what they are wanting me to pay. I are feeling too ill to giving all the detales but sum total are running into plenty monies. Hoken-Saki I are not believing I are burning out 4,326 tubes!! I are noticing that they also charging me with time on three networks, as it seems sponsors are not wanting to pay out hard-earned bux to have peeples listening to Scratchi rag-chewing.

My first reackshun was to rite to F.C.C., protesting that amateurs are not interesting financially in radio, but I are realizing that F.C.C. are probably wanting my address rite now, as are probably having nice stack of pink QSL cards all set to male.

Rite now I are hiding in kave, and hoping posse and hoards of lawyers are not finding me until I have chance to get clothes packed and hed to less active part of this countries. I'll be keeping in touch with you if I are getting away without having to play part of Xmas decoration on sum high caktus.

Respectively yours,
Hashafisti Scratchi