ARR-41 AUDIO BOOSTER : 73, DEC 79 P.50

Another Surplus Treasure

—convert the R-648/ARR-41 receiver

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How would you like to have a general-coverage communications receiver that covers from 150 kHz to 25 MHz and features digital tuning for a bargain price?

The R-648/ARR-41 receiver has been showing up in surplus channels lately, and it has these requirements. For about $100 to $175 you get the above features and much more. Here are some other features it has: an oven-controlled crystal calibrator that generates calibration points every 250 kHz, double conversion on nearly all frequencies, switchable selectivity (via Collins mechanical filters), permeability-tuned vfo, modular construction, two rf stages, and so on. It's also easy to convert for home use, a definite boon in my opinion because that is where I do all my listening!

For years, I have been interested in SWLing, and, since few ham band transceivers cover the international shortwave bands, I have been unable to do any SWLing. Reviews in *73 Magazine* of shortwave general-coverage receivers had fired

me up enough to seriously look into buying one of these units — that is, until I checked prices. So I put off buying a general-coverage receiver for a while. Then Fair Radio Sales of Lima, Ohio, started advertising the military surplus R-648 radio receiver at a price I could afford to pay. Before long, the postman was delivering a large box, and that is what led up to this article.

Naturally, the first thing I did was unpack the unit and pull the cover off, exposing the works. It's a rather hefty set by today's standards, weighing about 30 pounds, and is about the size of the old BC-348 (remember that?) aircraft receiver. My unit was built for the Navy, apparently around 1961, according to the date codes on the various parts. So it is not too old. This set has a lot of interesting features, such as essentially all parts are contained in six plug-in modules. Each module comes out simply by removing the red painted screws. Even the front end comes out. Loosen a few screws and it lifts out, mechanical tuning section and all. I might add that this set is permeability-tuned like a car radio — there are a bunch of ferrite slugs moving in and out of coils on this set. The front panel can be swung down and unplugged from the receiver, too, a decided asset because my unit had a burned-out power switch. Replacement was easy.

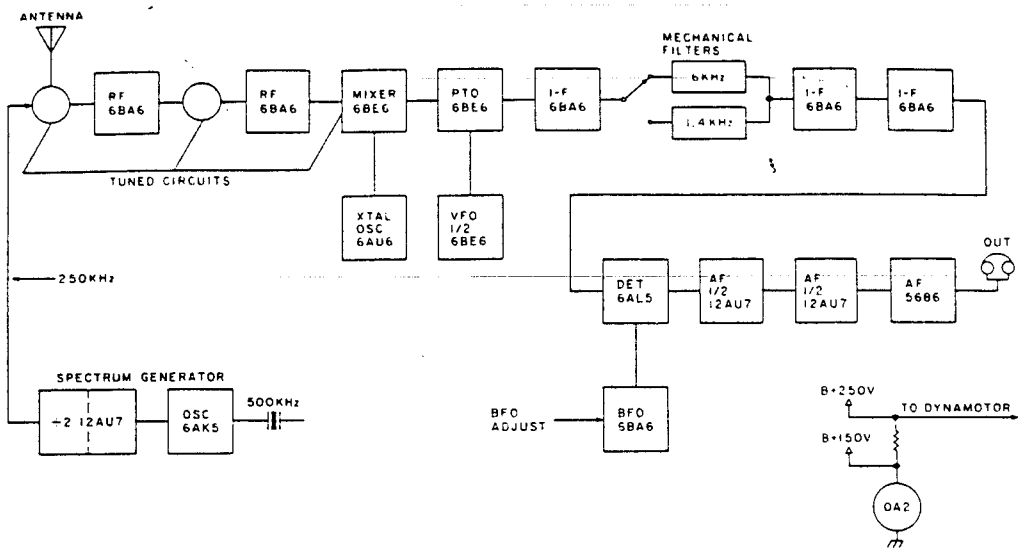
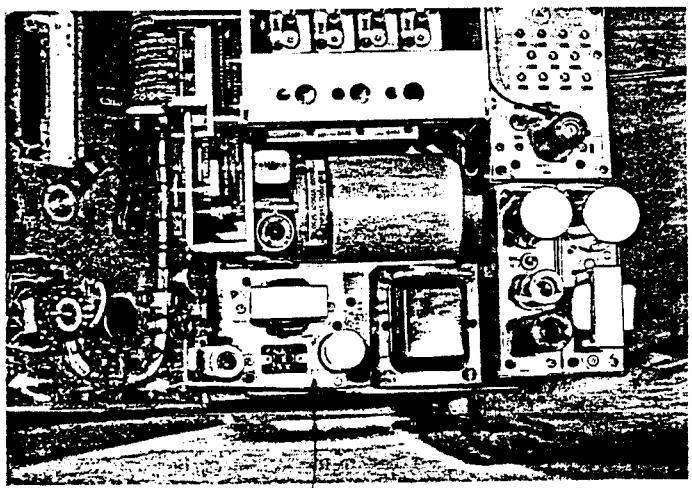
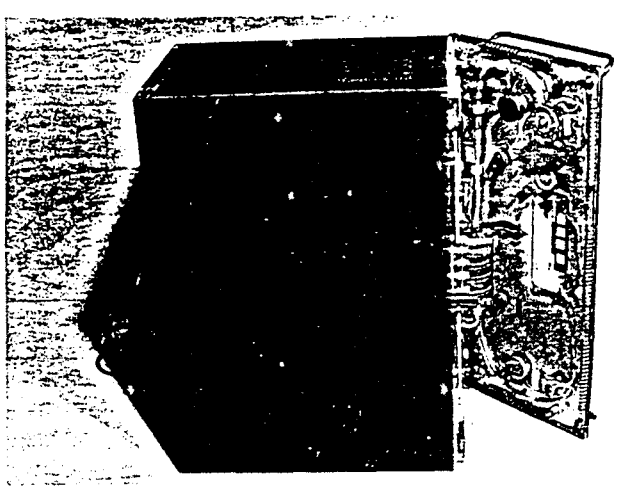


Fig. 1. Block diagram of R-648/ARR-41.

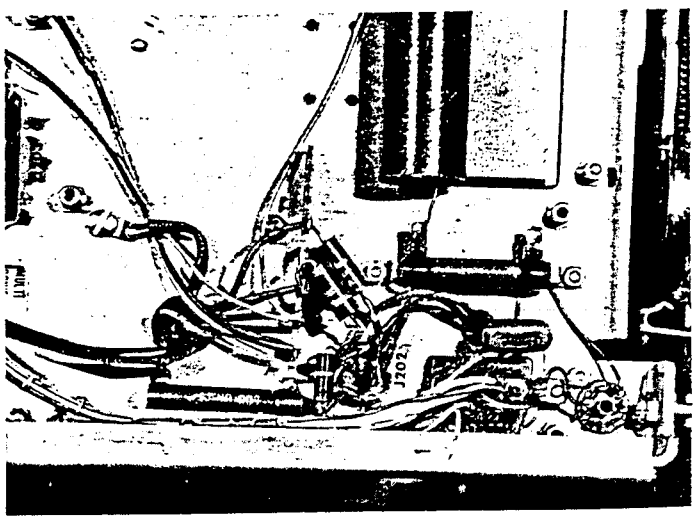
I purchased a schematic diagram of this set from Fair, so I could figure out what I bought and how to convert it for home use. Fig. 1 shows a block diagram of the R-648/ARR-41. Two rf stages amplify the signal from the antenna and drive a mixer stage. If I remember correctly, two rf stages are not used for gain; they isolate the antenna from the local oscillator, preventing rf signals from reaching the antenna. This could give enemy forces a signal to track with. The mixer is driven by a crystal-controlled local oscillator. This is the first signal conversion. The output signal drives a converter stage, which is housed in the permeability-tuned (PTO) vfo section. This section is tuned directly by the "Kilocycles" dial. The crystal oscillator crystals and the proper coils are selected by the "Megacycles" dial, by contrast. The PTO converter accepts signals either from the mixer stage or directly from its rf amplifiers



Top view again. Converted power supply is located next to hand in this picture.



Top view of receiver. Front panel swings out and may be completely removed.



Close-up of power supply components under chassis.

on some bands. I have rather sketchy information on this part of the set, but I would guess the PTO converter runs "straight through" on the 2 to 3 MHz band. The output of the converter then drives 3 stages of i-f. In the middle of these stages, there are two Collins mechanical filters, one 6.0 kHz wide and one 1.4 kHz wide.

The 6 kHz bandwidth is too wide for most communications today, but it works fine for the A3 modulation used for international broadcasters. The 1.4 kHz filter worked okay for SSB, which was surprisingly easy to tune in on a surplus receiver (ever try an ARC-5?), but a sharper filter would be nice. The i-f frequency is 500 kHz, by the way. Following the i-f stages, there is a diode-tuned bfo (no tuning cap on the front panel), a detector, noise limiter, and avc gate. Nothing's really new here. Rounding out the set, there are three stages of audio. Surprisingly, this set suffered from the well-known "headset audio" which surplus receivers seem to be prone to. After I had the set running, I modified it for more output. There is also a crystal calibrator (which they call a "spectrum gencrator"). It has a 500 kHz crystal in an oven, which is divided by two for the calibration markers.

That's a quick summary of what's inside the R-648 receiver. The next step is to convert it so you can use it.

Once I had an idea of what I'd bought, I decided to clean it up a little. You might want to do the same things I did; they may save you troubleshooting later. First, I removed each of the tubes and tested them. Since all of the tubes are numbered (e.g., 5750 instead of 6BE6), you'll need the chart of Fig. 2 to convert your tubes into ones that can be tested on most tube testers. You'll probably have trouble testing the 5686 — there is no equivalent for it. I had to test mine in an industrial tube tester. As I removed each tube and tested it, my curiousity got the better of me and I removed the modules and lifted the covers. I looked for burned parts and loose hardware. This was time well spent because I found several loose ground lugs. These things take only a few hours to do, and I suggest you do the same. I'm sure they saved me troubleshooting intermittents!

I finished up with the usual stuff — I installed new dial lamps, sprayed pot cleaner on the controls and switches, and lubricated the tuning gears. If you are lucky enough to get a mint unit, you may not have to do all this. But it is easy work.

I looked into converting this unit and devised three ways. You are welcome to pick the one you like. They are arranged in the order of the amount of time they take to do, with the quickest one first.

The first method is hardly a conversion at all. You simply hang an antenna, a pair of 600-Ohm phones, and a 24-volt power source on the receiver. There is one flaw in this conversion; the dynamotor must be in place for it to work. I didn't get the dynamotor, so I couldn't try this method. Then you'll need 24 volts. Either get a 24-volt, 10-Amp power supply or two 12-volt car batteries in series. Connect the negative lead from the power supply/batteries to pins B and E on power jack J-301. Then tie the positive lead to pin D of the same jack. Plug in an antenna and headphones (stereo headphones will do in a pinch). Flip the power switch on, and you should be rewarded with a big squall from the dynamotor. A few moments later, you should get noise in the phones and then the usual SW-type stuff.

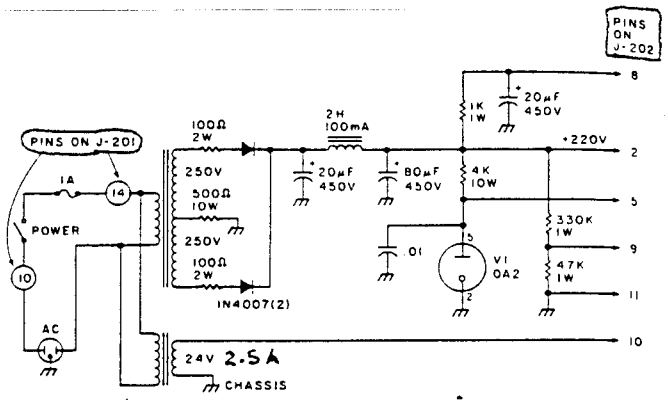
The next conversion method will probably follow after you or your wife gets tired of the racket from the dynamotor. You remove the offending dynamotor and replace it with a power supply, naturally. If you choose your parts carefully, you can mount everything in the space left by the dynamotor. Fig. 3 shows the details. The first thing you do is find a 24-volt filament transformer. The filaments draw slightly more than an Amp — about 1.25 Amps, as I recall — so you would use a 2.5-Amp transformer. The B+ supply needs 250 volts at around 70 mA; a standard receiver power transformer would work here. Since power transformers are expensive, you will probably want to scrounge for one. Another prospect is the Fair Radio model 818 transformer. It has a 500 V c-t, 80 mA winding and a 24-volt, 2-Amp winding, and it sells for $10.75. I haven't tried it in this application, but it looks small enough to fit in the dynamotor well and provide all the voltages. I followed this method using the power supply shown, and you can see my handiwork in the photos. All of the parts mount directly on the chassis, as you can see. The 0A2 tube was used as per the original circuit. You might get a 150-volt, 10-Watt zener diode and use it instead.

I found the parts at a local flea market. Someone sold me an old Bogen AM/FM tuner for a dollar, and I ended up with the necessary 500-volt c-t transformer, a filter choke of about 2 henrys, and a set of spare tubes, which is not bad for a dollar. I did have to rewire the filaments for 6.3 volts, though, but the savings was worth it. I did include a 500-Ohm, 10-Watt resistor in the center-tap lead of the transformer. This was done so the receiver would run a little cooler — the B+ fell to 220 volts.

The third modification is

Type in Receiver	Standard Type Replacement
5654	6AK5
5686	No sub.
5726	6AL5
5749	6BA6
5750	6BE6
5814	12AU7

Fig. 2. This list "decodes" the numbered tubes found in the receiver.

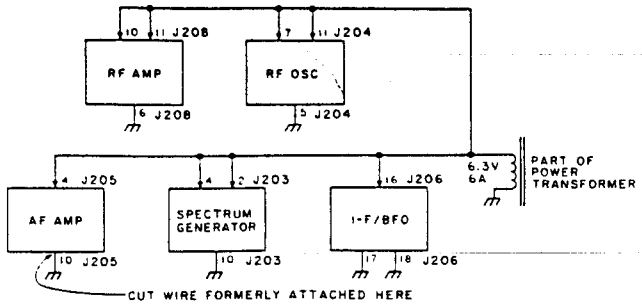


Transformer Requirements

	Minimum*		Suggested (get this one)
B+	250-0-250 volts at 70 mA	=	250-0-250 volts at 100 to 120 mA
Fil.	24 volts at 1.25 Amps	=	24 volts at 2.5 Amps
	or**		or**
	6 3 volts at 4 Amps	=	6.3 volts at 6 Amps

*This is the current the set draws.
**Used in the last conversion method only.

Fig. 3. Power supply schematic. You may have to juggle some resistor values to get the correct output voltages, but get 220 to 250 volts on the main B+ line, and you are all set.



Module	Conversion	Power input
I-f bfo assembly	connect pin 3, V505 to pin 16, P-501	6.3 volts to pin 16, P501 ground pins 17 and 18, P501
Af amplifier assembly	ground pin 9, V1301	6.3 volts to pin 4, P1301 ground to pin 10, P1301
Rf oscillator assembly	no mod	6.3 volts to pin 7 or 11, P601 ground to pin 5, P601
Spectrum generator assembly	1. jumper pins 4 and 2 on P750	
	2. remove R754 (39 Ohm, 2 W)	6.3 volts to pins 4 and 2, P750
	3. ground pin 4 of V750 or pin 9 of V751	ground to pin 10, P750
Rf amplifier assembly	1. ground pin 4, V701	
	2. cut wire on pin 4, V702, then ground this wire	6.3 volts to pins 10 and 11, P701
	3. add jumper to pin 4, V702, and connect to pin 4, V703	ground to pin 6, P701
	4. jumper pins 10 and 11 of P701	

Fig. 4. Wiring data for 6.3-volt filaments.

the most ambitious of all. I used the power supply discussed before, but I rewired all of the filaments. You may not want to do this if you don't care to tinker with the converted receiver; I like to tinker and I like to be able to remove modules without worrying if other tubes' filaments will not be lit if I pull a module. In other words, this is a bit of a job. But, since I made this conversion, I have switched to a solid state audio system (contained within the audio module) and eliminated two 6AL5 tubes, cutting several Amps of current drain off the filament line. This means a cooler-running set and better stability. You can see the solid state module in the photos. The calibrator will be converted next.

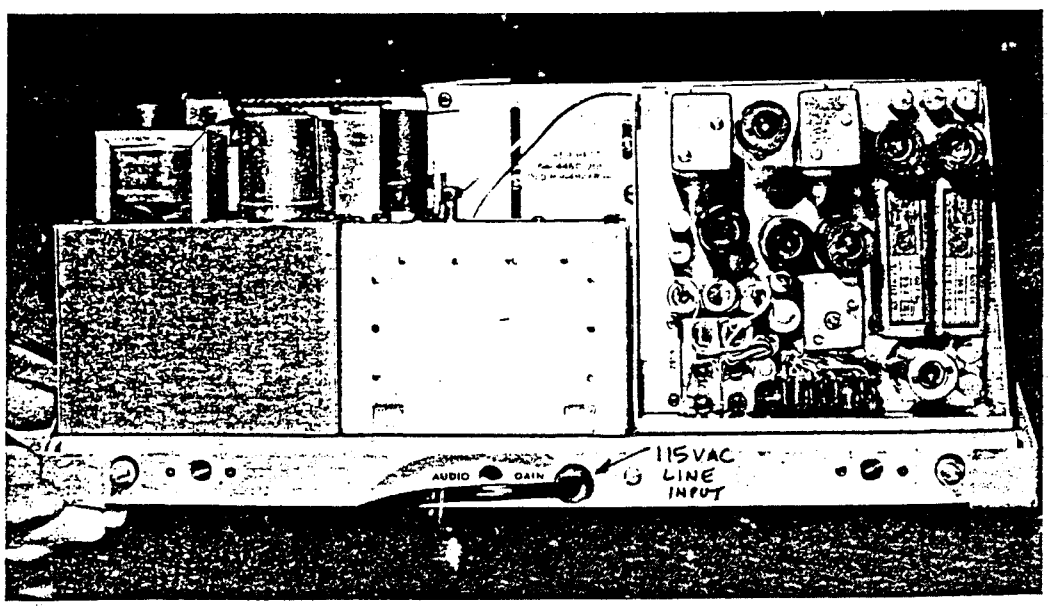
Fig. 4 shows a rundown of the filament conversion to 6.3 volts. Modify the modules first and check them out by applying power to the pins listed under "power in." Then turn your attention to the main chassis and bus the pins of each module together using 16-gauge wire. This is about a two-evening job. You will then need a 6.3-volt, 5- to 6-Amp transformer, as the filaments draw about 4 Amps. It's not a job for everyone's tastes, but the flexibility may be worth it.

Now that you have done the conversion, a few improvements may be in order. The first thing you can do is change T1301, the output transformer on the audio amplifier assembly. Get a small output transformer of 14k Ohms to 8 Ohms. A small universal output transformer will do if you select the right taps. Try to mount it in place of the old square transformer if you can, but, in all likelihood, you will have to mount it on its side or make a bracket or devise some other way to make it fit. But, after it's installed, you will be able to drive a speaker to fair volume if you wish.

Another thing you will probably want to do is rewire the fuse holder and power switch on the front panel so that they control the ac power and not the filament line. Cut the leads on the power switch and splice them together. Then do the same with the fuse holder. This is so the dial lamps will continue to light. Run external wires between the fuse and power switch and the two unused connections on P-304/J201 connectors. Then run one side of your power transformer(s) to one connection, and one side of the ac cord to the other unused connection. In my unit, the pins used were 10 and 14. Oh yes, change the fuse to 1 Amp.

How well can you expect the receiver to work? It proved to be very sensitive over the tuning range. Selectivity was okay for SW but a little too broad for the crowded ham bands. Stability was quite good, and SSB stations tended to stay put for a while. In all, a successful conversion!

I will be happy to try to answer your letters, if you enclose an SASE. ■



Rear view of receiver.

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Audio Booster for Mil-Surplus Receivers

— a must for headphone haters

One of my biggest pet peeves with military surplus radio equipment is the low audio output of some sets. And that is the one big problem with the R-648/ARR-41 radio receiver that I converted recently. (See "Another Surplus Treasure," *73 Magazine*, November, 1978.) This receiver worked fine with headphones, but not when the output transformer was changed for a speaker. If you have done much work at all with surplus radio equipment, you know what I am talking about!

After studying the schematic of the audio stages, I saw that the best route would be to change the 5686 output tube to something heftier — like a 6AQ5. You could do it but for one

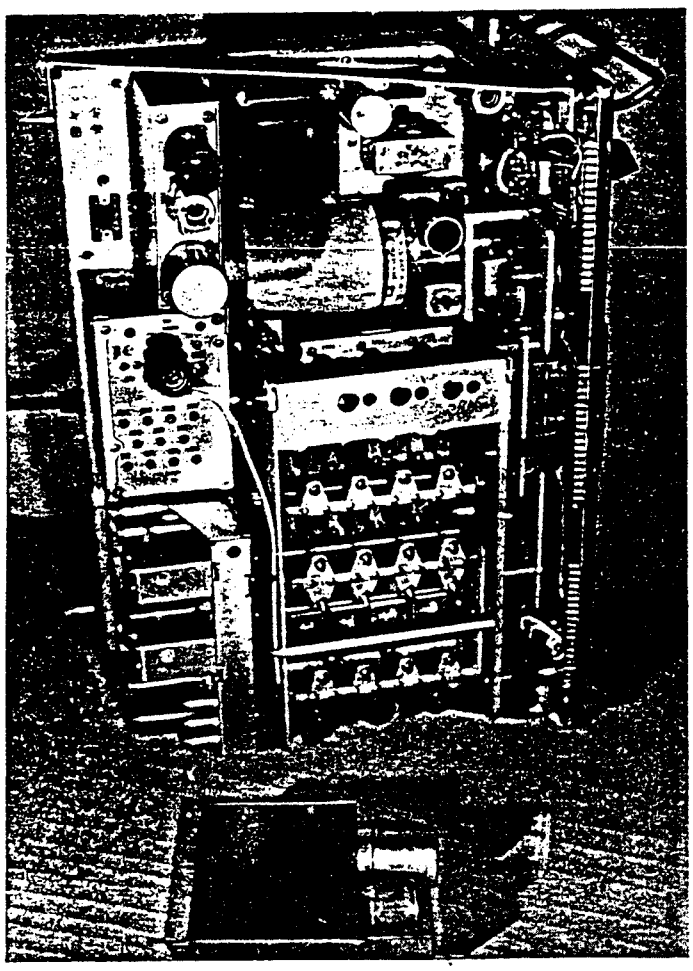

Photo A. Plug-in audio amp with rig.

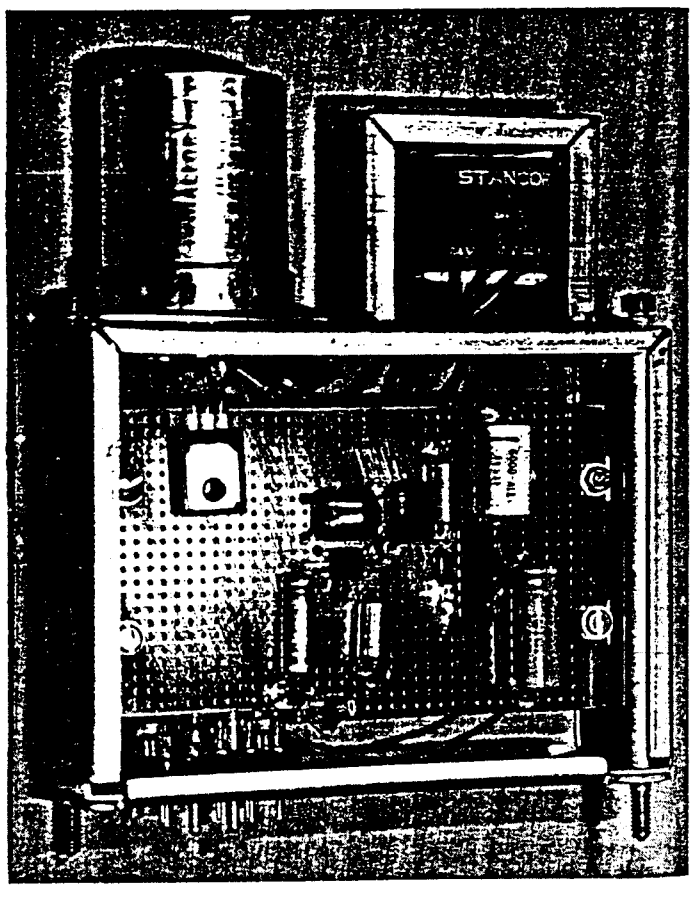

Photo B. Interior view of amplifier.

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thing: Mounting the tube could create a height problem with the case. Also, you would upset the filament string in this series string set. So that was out.

The next best thing turned out to be a whole new audio amplifier, built from the ground up. This turned out to be a fairly easy job; an IC "building block" amplifier was pressed into service. It was possible to mount all parts in the module case, too, and the whole thing makes up a neat plug-in package. Oh yes, there is plenty of volume with a speaker now!

If you are working with other surplus sets and need an audio boost, this amplifier may do it for you. It is cheap to build, takes little room, produces little heat and creates a heck of a lot of volume. You are welcome to try it in your own unit; in this article, however, I will concentrate on the R-648 receiver conversion.

Before getting started with the actual wiring, let's take a look at what is being modified in the R-648. If you check out Fig. 1, you will see a simplified diagram of the receiver's audio section. Basically, you have two stages of gain (5814) and a stage of power (5686). The 5686 tube is the bottleneck here. The tube just won't draw enough plate current for any real power output, and is a poor choice for an audio output, especially since it sits there and draws 300 mA at 6.3 volts. It's a better heater-dropping resistor than output tube!

Note particularly the cathode connection of the first audio stage. Resistor R1305 is in series with the tube cathode and a pot on the front panel. This is the volume control. It is unique in that no audio signals pass down it, preventing hum pickup, yet making shielded cable from the volume control unnecessary. This is called a "dc volume control" and is used widely in IC-generation TV sets today. It is important to us because we are going to use it in our modification.

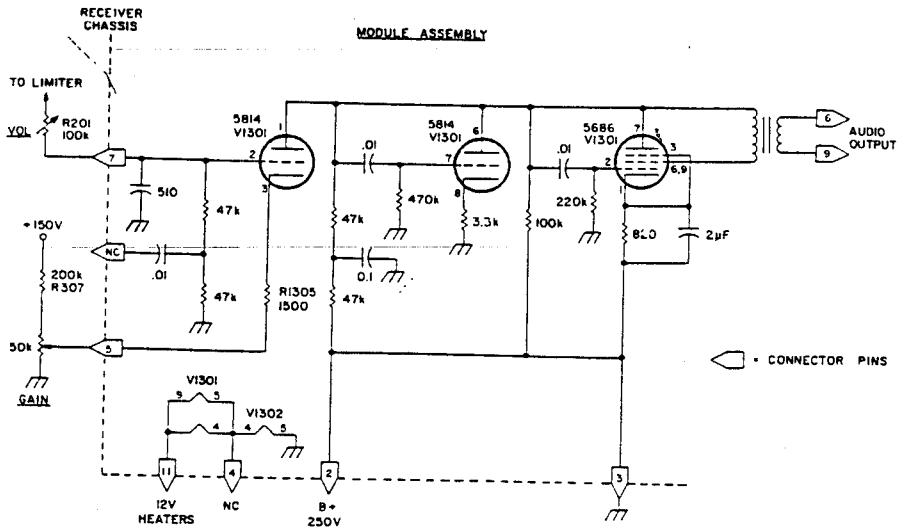

Fig. 1. Existing audio section of R-648.

The schematic shows what goes in place of the two tubes: two low-cost ICs. One IC you are probably familiar with—the National LM-380. This is the 2½-Watt power amplifier job. It is a natural for this job. The other one is a little less known, and that's too bad, because it is very useful. This IC is the Motorola MFC-6040 or Motorola HEPC6009. It is an electronic attenuator. It attenuates a signal when either a resistor to ground or voltage is applied to a control pin. There is no gain added, just attenuation. A simple 12-volt power supply rounds out the modification.

Construction is easy. I would suggest, however, that if your R-648 still has the tube filaments wired for 24 volts, leave the tube filaments in the audio module wired up. This will make sure that the other tubes get the proper voltages. One good advantage, besides the fact you eliminate several power resistors, is that the tubes can be bad. Just the filaments have to be good.

The photos and the schematic tell the construction story pretty well. I must add that I rewired the filaments in my receiver for 6.3 volts, so I was able to mount all parts in the schematic on the original module. This made a neat package. If you leave in the tubes, as required for the old 24-volt filament string, you will have to mount the power transformer elsewhere. I might add, at this point, that I tried a half-wave rectifier and filter directly from the 24-volt filament supply, but I had to supply a huge amount of filtering, and I had to drop the voltage to IC3 (voltage regulator) because it exceeded the chip's ratings. In the long run, a separate transformer for the audio amp power supply takes up less space, reduces construction frus-

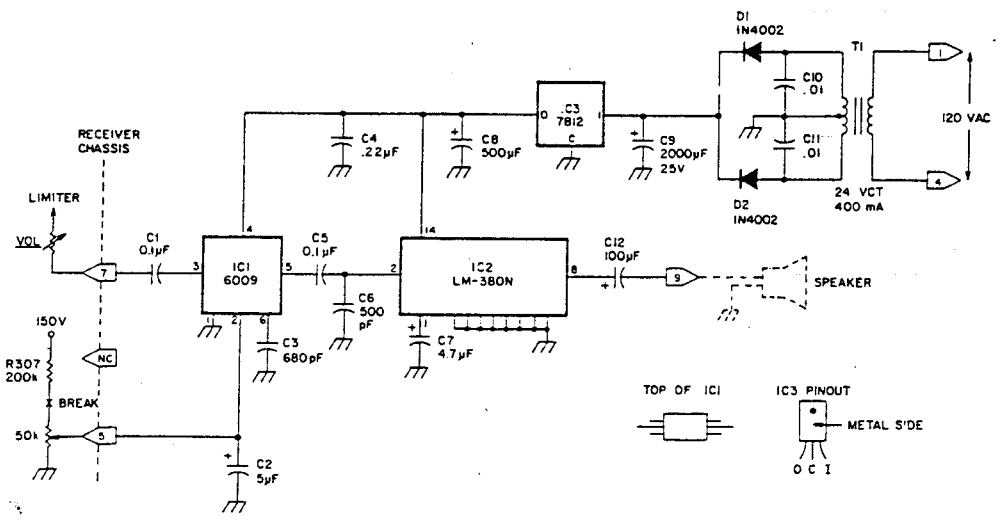

Fig. 2. Schematic diagram.

Parts List

C1, C5—0.1-uF disc or mylar® caps
C2, C7—4.7- or 5-uF, 16-volt electrolytic caps
C3—680-pF disc cap
C4—0.22-uF mylar cap
C6—500- or 470-pF disc cap
C8—500-uF, 16-volt electrolytic cap
C9—2000-uF, 25-volt electrolytic cap
C10, C11—0.01-uF disc caps
C12—100-uF, 16-volt electrolytic cap
D1, D2—1N4002 rectifier diodes
IC1—Motorola HEPC6009 or MFC-6040 attenuator IC
IC2—National LM380N power amp IC
IC3—7812 voltage regulator; 12 volts at 1 Amp
T1—24 volt c-t, 400-mA power transformer

tration, and possibly is cheaper.

I started construction by removing all components from the audio module, save the connector. Inside, I mounted a piece of copperclad "ground plane" perfboard, which serves as shielding and a heat sink for IC2. You don't have to duplicate this method of construction—copperclad perfboard is rather expensive—but at the least you must solder some kind of heat sink to the *grounded* leads of IC2. Two pieces of shim brass cut to size will do fine.

IC3 does not have to be heat-sinked, as its power dissipation is very low. You can see this IC in my unit mounted upside down under the filter capacitor.

The rest of the construction is noncritical and needs little comment. You might want to shield the input lead around C1 to the connector to cut hum pickup, though. In my unit, the 120 volts ac for T1 went to pins 1 and 4 of the connector. If you must leave the tubes in, you will have a wire connected to pin 4. This wire is not used inside the set, so cut it off inside the module and use pins 1 and 4 to carry the 12 volts from the added power supply to the audio circuitry. (Mount T1, IC3, etc., on the receiver chassis.)

After you have rewired the module, you will have to make a few additions on the main chassis. In my case, I ran 120 volts ac to pins 1 and 4 of the audio module chassis socket. If you kept the tubes in as ballast resistors, you will have to build the 12-volt power supply externally, and feed in the regulated voltage through the proper pins. After that is done, you must make one more change. Resistor R307 on the front panel must be disconnected or the attenuator IC will receive B+ through the *gain* control. This should be very easy. Unlatch the front panel and look at the rear section of the gain control. In my receiver, there was a yellow wire tied to the CW or far left-hand lug on the control. I cut it and I was home free.

After these modifications were complete, the receiver worked fine, and with room-filling volume! I haven't tried this modification on other surplus sets, but it should work if the proper power-supply voltages are available. And, oh yes! This conversion has other benefits, too. Besides a dramatic increase in volume, and less heat, the dc volume control can be switched and used as part of a squelch or noise blanker scheme. Or, how about a Selcal system? ■

Reader Service—see page 259

Converting Surplus Aircraft Receivers for SWL Use

by Mark Starin KB1KJ

The following article is a circuit description and conversion scheme for the R-648/ARR-41 receiver. The information is typical of most surplus aircraft radios available today. All, for example, use 28 volts for power and operate in a similar manner. Consequently the information contained in this article is a good guideline for understanding the operation and conversion of any of this class of radio.

Generally speaking, any of these units will provide an excellent receiver for the shortwave listener or radio amateur. In many cases, they'll also outperform most new receivers costing twice the price. The effort required to make the necessary conversion is time and money well spent.

The R-648/ARR-41 is designed and manufactured by Collins Radio. It tunes from 190 to 550 kHz and 2 to 25 MHz in one kilohertz increments over five frequency ranges. The receiver consists of eight plug in assemblies which are easily removed for troubleshooting. It also features 1.4 kHz and 6.0 kHz mechanical filters. Power required is +28 volts at 4 amps. All you need then to operate this receiver is a +28 volt supply, headphones or speaker and antenna.

Theory of Operation

Figure one shows a block diagram of the receiver. Incoming signals are received by the antenna and applied to one of five tuned circuits, depending upon the band of reception. The signals are then applied to the grid of the first RF amplifier (V701) for amplification. After first RF amplification, frequencies within the range of bands 1, 3, 4 and 5 are applied through tuned circuits to the second RF amplifier and then through additional tuned circuits to the first mixer (V703).

The function of the first mixer and RF oscillator (V601) is to heterodyne the incoming RF and produce a variable IF of 2.0 to 4.0 MHz Band 2 frequencies are 2.0 to 4.0 MHz without heterodyning and are therefore switched around the second RF amplifier and first mixer circuits. All bands of frequencies are then within the range of 2.0 to 4.0 MHz and are applied through the variable intermediate frequency-tuned circuits to the variable frequency oscillator converter (VFOC).

The VFOC heterodynes the incoming 2 to 4 MHz signals with a locally-generated 2.5 to 3.5 MHz signal, producing an output of 500 kHz (the second IF). This signal is then applied to the grid of V501 for amplification. Output of V501 passes through either a 6 or 1.4 kHz mechanical filter, depending upon the setting of the emission switch and through one of two second IF amplifiers.

The IF signal is then applied through another tuned circuit to the grid of the third IF amplifier (V504). Tuned circuit Z504 couples the output of the third IF amplifier to the detector (V505) which recovers the modulation component of the IF signal and produces a negative voltage proportional to the carrier level for automatic volume control.

BFO output can be routed to the detector input by setting the emission switch to either CW or CW SHP positions. A beat note is then produced with the 500 kHz IF signal to allow CW reception. Output from the detector is then applied to the limiter/AVC gate (V506).

One half of a dual diode V506 functions as an AVC gate control and prevents application of lAVC voltage to the various

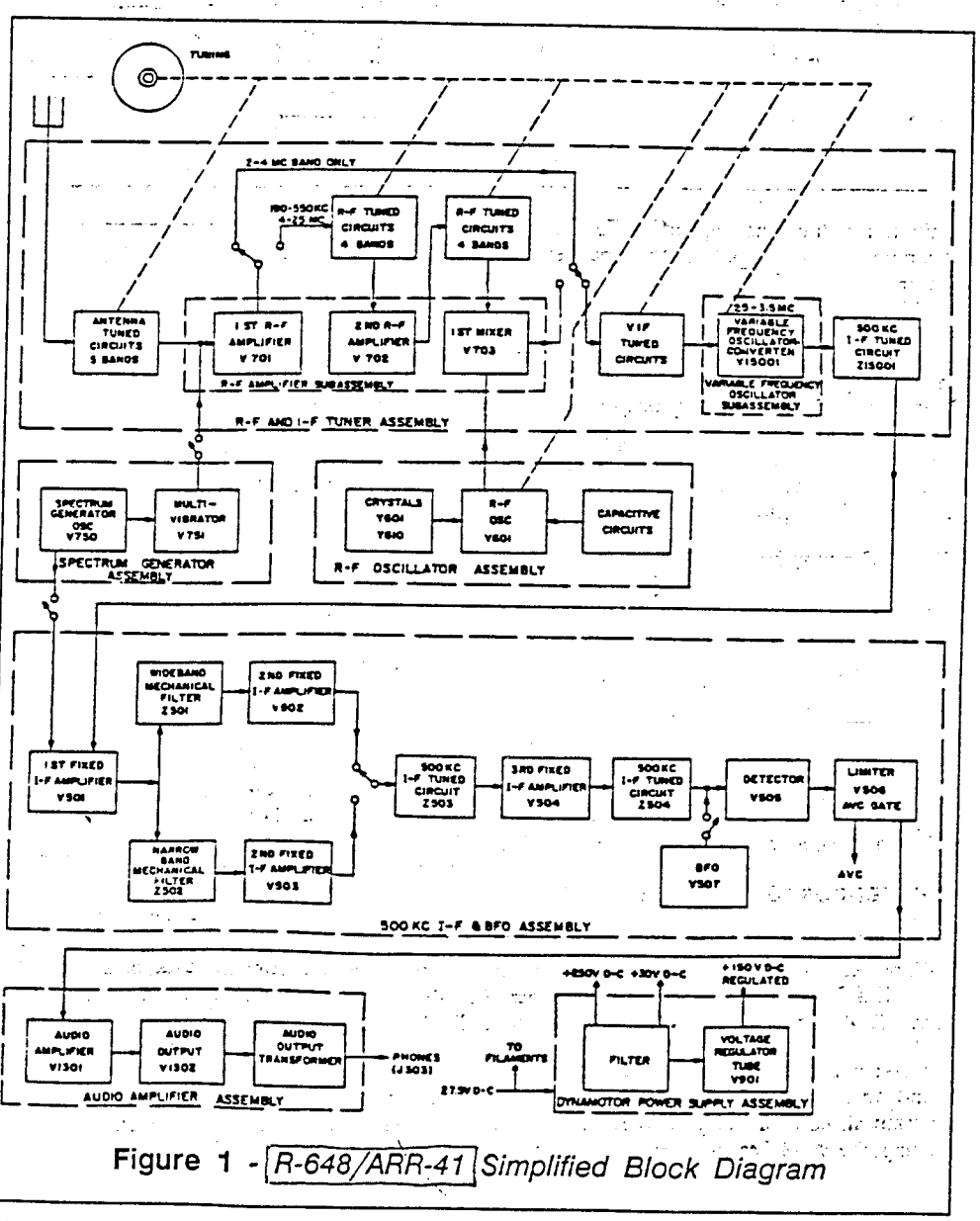

Figure 1 - R-648/ARR-41 Simplified Block Diagram

amplifiers until full receiver sensitivity is achieved. The other half of 1V-506 is a noise limiter which suppresses undesired noise pulses.

Output of V506 is an audio voltage proportional to the modulation of the incoming RF signal. Audio amplifier V1302 and audio output V1302 amplify the audio signal. Phone jack J303 is connected to audio output transformer T1301 and is located on the front panel of the receiver. The spectrum generator consists of a crystal-controlled oscillator and a multivibrator/ divider circuit.

Monitoring Times invites you to submit your favorite projects for publication. For more information, contact technical editor Ike Kerschner at RD 1, Box 181A, Kunkletown, PA 18085.

The crystal controlled oscillator (V750) produces a 500 kHz calibration signal. This signal is then applied to the grid of the first IF amplifier (V501) and to one plate and grid of multivibrator-divider V751. The multivibrator fires on every fifth input pulse and produces an output to the first RF amplifier of 100 kHz. This 100 kHz signal is rich in harmonics and allows the IRF circuits to tune to a particular harmonic, depending upon the resonant frequency of the tuned circuits. A beat note is produced as a result of heterodyning the 500 kHz signal applied to the first IF amplifier with the selected harmonic of the multivibrator.

This beat note is heard when the receiver frequency is varied around the selected multivibrator harmonic and the correct receiver frequency is verified via the counter indication on the front panel. The counter can then be set to the exact 100 kHz multiple using the DIAL ZERO control and calibration is complete.

The dynamotor power supply normally converts the +28 source voltage into a usable output for the screens and plates of the receiver tubes. The necessary filter and divider circuits are employed to produce +250V, +150V regulated, and +30 V for AVC delay bias.

Conversion Information

While the dynamotor supply normally mounted inside the receiver can be used for initial checkout of the unit, it should be noted that dynamotors are not very efficient DC to DC converters. In addition, dynamotors typically draw up to 20 amps of surge current at startup (not every ham or SWL shack has a +28V 20 amp supply on hand). It is much easier to use the old dynamotor supply components as a foundation for a replacement transistorized DC to DC converter and obtain a +28V 6 amp power supply as a primary power source. A suggested circuit is shown in figure three.

It might also be possible to plug in a AC powered supply in place of the dynamotor but I recommend sticking with a DC to DC converter. The reason is that AC on the filaments of the receiver tubes could produce an annoying hum in your headphones or speaker, not to mention design changes in the filament circuits. Using +28 volts for the filaments eliminates that problem and provides a convenient source for your DC to DC converter.

Operating the Receiver

Operation of the receiver is straightforward. Connect the receiver power cable from your DC power source to the receiver front panel (J301). Connect an antenna to J302 and a pair of 600 ohm headphones or loudspeaker to J303. Set POWER OFF-ON switch to ON. The dynamotor should start up right away or there should be a faint whine from the replacement inverter if it is installed. Allow the receiver to warm up for 15 minutes.

Set the BANDSWITCH control to the range of interest. Set the EMISSION switch to CAL and set TUNING control to a 100 kHz point nearest the desired frequency (example 3580 kHz = 3600 kHz checkpoint frequency). Slowly rock the TUNING control through checkpoint frequency and set to Zero-beat. Press DIAL ZERO control and rotate until indication on MEGACYCLES window corresponds to nearest checkpoint frequency.

Set EMISSION switch to VOICE, VOICE-SHP, CW or CW-SHP as desired. Adjust TUNING control to desired frequency and GAIN and SLENS ADJ controls for appropriate listening levels. To copy CW or SSB, adjust the BFO control for desired CW tone or best voice intelligibility.

648/ARR-41 receivers and accessories are currently available from Fair Radio Sales Co., PO Box 1105, 1016 E. Eureka Street, Lima OH 45802 (write for current prices).

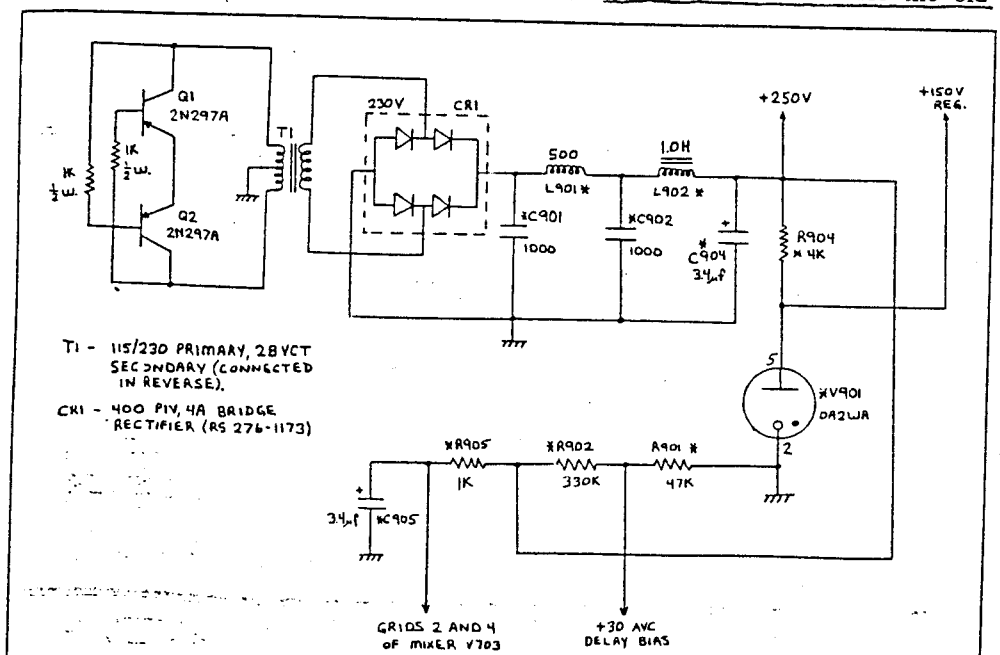

Figure 2 - *Suggested Transistorized DC-to-DC Inverter Circuit*

Projects for Experimenter's Workshop, while reviewed by our Technical Editor, are submitted by readers and remain experimental.

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[*Continued on page 70*]

SURPLUS sidelights

BY GORDON ELIOT WHITE*

A "new" item has surfaced in the surplus markets recently, the Collins' R-648/ARR-41 receiver. After a long run of over-specialized surplus, the ARR-41 has finally turned up, an eminently usable piece of gear for amateurs or s.w.ls.

This receiver is of course not really new; it came along in the mid-1950's as an aircraft set for general purpose use in multi-engine planes which carried radio operators. It is capable of receiving a.m., c.w., or FSK (RTTY). Frequency coverage is 190-550 kHz and 2-25 mHz.

The design sprang from the same roots as the familiar Collins' R-389, R-390, R-390-A, R-391 and R-392, a family of low and high-frequency sets based on the permeability-tuned oscillator which Arthur Andrews Collins designed some twenty-five years ago. Like the R-390, the R-648/ARR-41 has a digital tuning readout and great accuracy in tuning along with excellent stability.

Collins, incidentally, has lost control of Collins Radio, and the company is now part of Rockwell International. Like many radio investors, Arthur Collins cared more for his brilliant technical work than for the mundane business of business. Technological supremacy carried Collins Radio through the post World War II era, but it floundered when inflation, military spending cuts, and tight money struck together in recent years. There is still a Collins Radio, but it is now a division in the Rockwell conglomerate empire.

Back to business.

The ARR-41 has begun to appear in surplus bid lists, and in dealers' hands. I hesitate to mention prices, but since it requires 28 volt power, and is designed for an aircraft mounting, the ARR-41 probably will not command the high price of the R-390. There will not be as many around as there have been of the long-lived R-390, either.

I have most recently heard from reader Charles Minot Jr., of Woodbury, N.J., that Selectronics, in Philadelphia, had some sets. It may be that they will have been sold by the time this column is published. But ARR-41's are appearing elsewhere.

It looks as though the ARR-41 may be a very nice set for the man who can brew up a rather simple power supply. Fig. 1 shows the original dynamotor system, which may be replaced by a transformer-rectifier set reasonably easily. Note that the B+ voltage is only 250, standard dynamotor supply. The receiver requires a regulated 150 volts d.c., and a small amount of 31 volt d.c. bias.

Tube filaments may be re-wired for six or twelve volts, or a 24 volt transformer used to supply the original voltage. Twenty-four volts are required for the ovens.

The ARR-41 is, of course a superheterodyne design. Double-conversion is used throughout its coverage except single-conversion on band two, 2 —4 mHz. (For those who think it is unnecessary to mention "superhet" these days, I can only say that it is not all *that* long ago that tuned-radio-frequency sets went the way of the dodo. Some are still turning up in surplus. Radio design engineers will tell you that for absolute ultimate sensitivity. TRF had it all over a superhet.)

Sensitivity of the ARR-41 is rated at 5 microvolts for 100 milliwatts audio output. For an h.f. receiver this is about all the sensitivity that you can use. Unfortunately I don't have signal to noise figures on the set.

Old-timers will recognize the ARR-41 as rather like the BC-348 WW II aircraft "liaison" sets in general appearance and dimensions. This is probably not a coincidence, since the ARR-41 was the liaison set of the 1950s and 1960s.

Unlike the BC-348, the ARR-41 has mechanical intermediate-frequency filters and 100 kHz crystal checkpoints.

Tuning is via the usual Collins' variable i.f.-multi-crystal system, a veritable forest of cams, tuning slugs, rods and springs. Hopefully, no one will twiddle with the adjustments and need to do a full alignment. It must be possible, but like re-calibrating a BC-221 frequency meter—you wouldn't want to try it.

heated thermostatically controlled over (HR-750), while over HR-1500 stabilizes the permea-

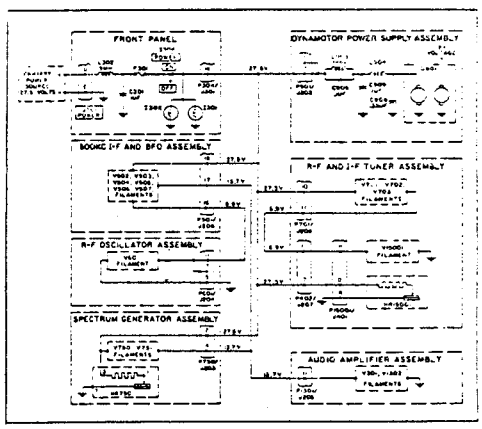

Fig. 1—Primary voltage distribution.

*1502 Stonewall Rd., Alexandria, Va. 22302

CQ'S DIAL-A-PROP

For the latest up to the minute propagation forecasts and special contest predictions call 516-883-6223 any time day or night for a recorded message on conditions.

bility tuner. The ovens do require 28 volts, by the way.

In disassembly, if required, by the way, the permeability-tuned Collins oscillator must be set for 190 kHz for removal. One of the set screws of coupler 0444 is inaccessible until the tuning is rotated slightly beyond 190 kHz, but the 190 reading must be re-set before removing the assembly. Generally modules are retained by green-painted captive screws. The pesky set screw mentioned above requires a #10 Bristol (fluted Allen) wrench.

The full ARR-41 diagram is too large to be reprinted here. ■

Awards [*from page 68*]

and contacts with Carson City may be used for Douglas, *or* Lyon, *or* Storey, *or* Washoe Counties—but *only* for *one* and only *once*. Thanks to all who passed along this data.

Dave Manescu, W6CCM of 13227 Beechtree St., Lakeside, California 92040, proposes (with help from others) to compile a listing of all members of the ICHN, MARAC and any others that share our common interests as County Hunters, and make it available at a minimum price to all. In addition to the listings (hope is for at least 750 County Hunters) it is hoped to include other information of interest to all. The target date is July 1975, but all information is needed as soon as possible. The pre-publication cost is $2.50. Please send s.a.s.e. to Dave for application/questionnaire and more data.

73, Ed, W2GT

FM [*from page 47*]

distance of five miles, this would require an ERP of nearly 500 watts!

In my opinion, the antenna gain and the antenna height are probably more important in most situations and a fairly simple antenna capable of delivering a legitimate six db gain can be had for about ten bucks. A v.h.f. power amplifier capable of raising a ten watt signal to 125 watts output will run you about $190 to buy and a bunch of headaches to build. The point that I think can be drawn from all of the above jazz is simply that running high-powered amplifiers on v.h.f. may or may not buy you enough on a "dollars per watt" basis to make them worthwhile. The real value of the power amplifier in f.m. becomes clear in any situation where antenna gain cannot be increased and/or antenna height cannot be improved. What do you think???

Philosophy Of The Month

If amplitude modulation techniques were so great (including s.s.b.), how come the Unified S Band system as used in most of the Space Communications of the last ten years uses f.m. and p.m.? 73, Norm, W2JUP

Armed Forces Test [*from page 40*]

in aligning and adjusting of equipme operator, and serves to demonstrate th number of amateurs becoming skill method of rapid communications. The sion will be as follows:

Transmitting Station	Frequencies (kHz unle otherwise indicated)
WAR—Army	4030, 6997.5, 1440
NSS—Navy	4012.5, 7385, 1438
NPG—Navy	4010, 7347.5, 1392 148.410 mHz
AIR—Air Force	7315, 13997.5

Submission For The Specic 25th Anniversary Certifica

A special certificate in observance o Anniversary of the Armed Forces D munication Tests will be awarded to a cipants who can show proof that t taken part in all 25 of the annual tests. the annual participation, participants sh mit to the address listed below, facsimil QSL card and/or certificate awarded receiving tests for each year. Origina not be submitted as they will not be re

Submission Of Test Entries

Transcriptions should be submitted ceived". No attempt should be made t possible transmission errors.