

# Adapter for the KWM-1 to 40 Meters

BY TAL LAWRENCE\*, W5GVZ

*With the drop in activity on 10, 15 and 20 many KWM-1 owners are frustrated. They would like to operate on 40 and 80 but won't modify their pride and joy. Here, however, is a converter that will permit operation of the KWM-1 on 40 meters and requires no modifications on the KWM-1.*

**T**HE many owners of the Collins KWM-1 are well aware that it is, without a doubt, one of the finest pieces of amateur gear ever built. These owners, however, face a problem; the long-range propagation forecasts look very bad for 10, 15 and 20 meters for an extended time. KWM-1 owners will all agree that it would be wonderful to be able to operate the M-1 on 40 meters, but also agree that modifications would be made over their dead bodies.

The little adapter described here will allow the M-1 to be operated on 40 meter lower sideband while retaining all of the very desirable features of 10, 15 and 20 meter operation. No modifications of any kind are made to the M-1.

## Receiver Theory of Operation

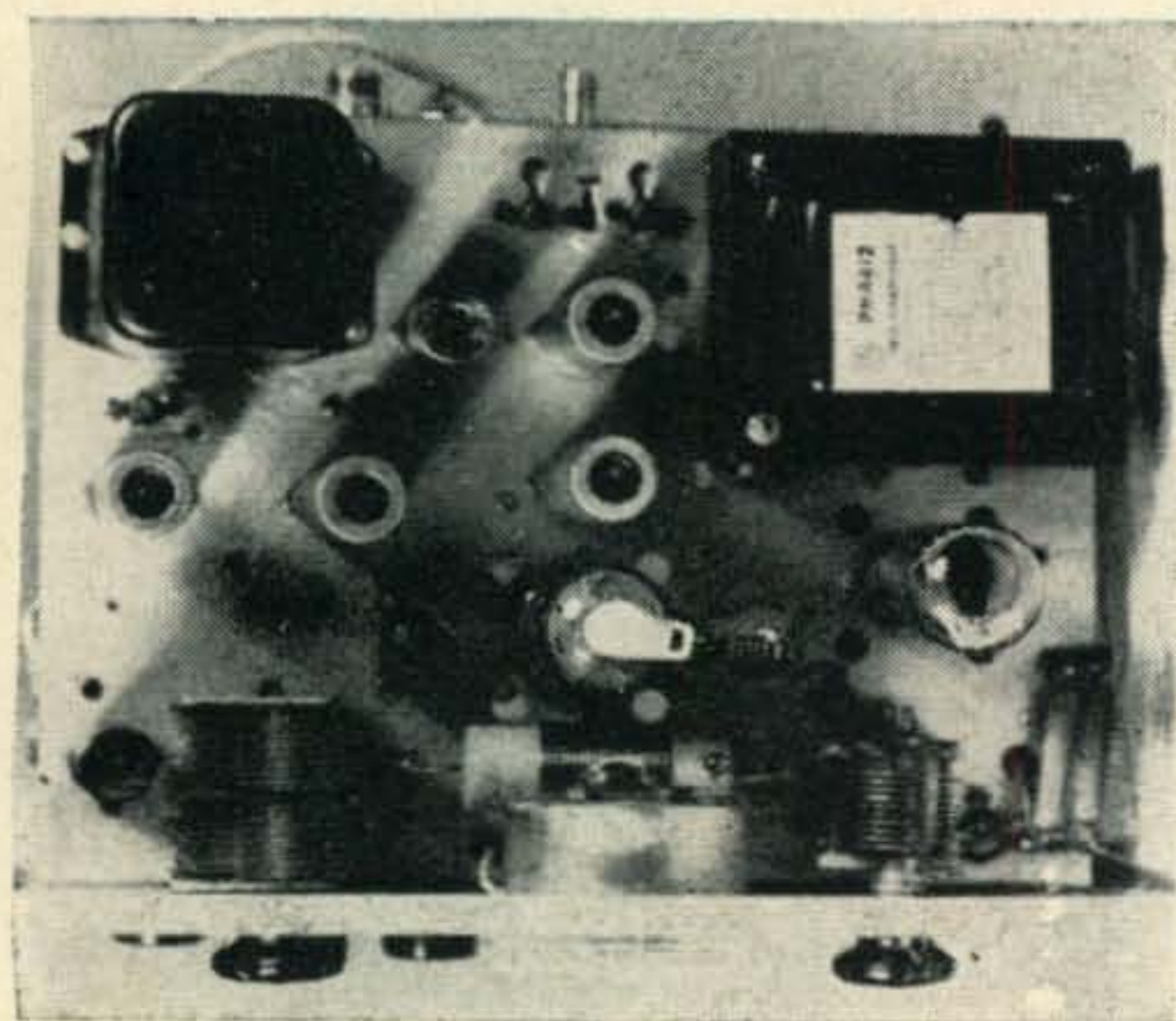
Referring to fig. 1, a 7200 kc l.s.b. signal is received by  $V_1$ , amplified and sent to  $V_2$ , a conventional mixer. Stage  $V_2$  also receives a 28,300 kc signal from  $V_3$ . Mixing action is as follows: 28,300 kc minus 7,200 kc l.s.b. equals 21,100 kc u.s.b. The only undesirable feature here is that the M-1 dial reads backwards. In

other words 21,000 kc will be the high end of 40 meters (28,300 minus 21,000 equals 7,300 kc). Also 21,100 kc on the M-1 dial will be the low end of 40 meters since we are subtracting in order to invert sidebands. Just remember, 100 on the M-1 dial is 7200 kc lower sideband providing the 5660 kc crystal is accurate.

## Transmitter Theory of Operation

Again referring to fig. 1, the KWM-1 is tuned to 21,100 kc, at full output, and is fed through a swamping network capacity coupled to the cathode of mixer  $V_4$ . A 28,300 kc signal from  $V_3$  is introduced here and mixing is as follows: 28,300 kc minus 21,100 kc u.s.b. equals 7,200 kc l.s.b. The 7,200 to 7,300 kc l.s.b. signal from  $V_4$  is à la Collins and must be kept this way as the power level is increased.

We're now receiving 7,200-7,300 kc l.s.b. as good, or possibly better than anyone on 40 meters and, we're transmitting on 7,200 kc to 7,300 kc l.s.b. as clean as a "hound's tooth." The power output from  $V_4$  is, of course, very low. At this point you may use an existing 40 meter amplifier, or you might pick up a bargain commercial rig. You may also want to build your own pet version of a driver final at any power level you feel adequate. The above is the secret of how it is done and this little Transceiver Heterodyner is the "Heart" of the package.



Top view of the Heterodyner. The r.f. amplifier,  $V_1$ , is located at the lower left. Above it is  $V_2$ , the receiver mixer. To the right is  $V_3$ , the crystal oscillator followed by  $V_6$  the driver. The crystal may be seen just below  $V_3$ . The 6146 is located behind the front panel and above it is  $V_6$  the driver and  $V_4$  the transmitter mixer. The v.r. tube is to the left of  $V_4$ . Inductor  $L_9$  is below the panel meter with the Antenna Loading capacitor on the left and p.a. Plate tuning on the right.



K<sub>1</sub>—3 p.d.t. 110 v.a.c. coil. Potter Brumfield MR14A or equiv.

L<sub>1</sub>, L<sub>3</sub>—3t hookup wire on cold end of L2 and L4.

L<sub>2</sub>, L<sub>4</sub>—17t #20, 1" diam., 16 t.p.i. B&W 3015.

L<sub>5</sub>—40t #22 on  $\frac{7}{8}$ " diam. form closewound.

L<sub>6</sub>—14t #22 on  $\frac{3}{8}$ " diam. form closewound.

L<sub>7</sub>—79t #22 on  $\frac{1}{2}$ " diam. form closewound.

L<sub>8</sub>—79t #22 on  $\frac{1}{2}$ " diam. form closewound.

L<sub>9</sub>—20t #12E on 1" form closewound.

PC<sub>1</sub>—5t #16 on 100 ohm 1w resistor.

The 0A2 regulator source voltage must be properly adjusted so that the tube stays ignited when the unit is switched from transmit to receive. This may be done by juggling the value of the upper 20K resistor in the power supply voltage divider, if necessary.

The negative 50 volts for the 6146 bias is necessary for class AB1 operation as required for s.s.b. This 50 volts may be obtained from batteries, a bias supply (must be added), or picked up from the Collins power supply. The choice is yours. The photos show a bias pot as a front panel control (5K). This also is optional.

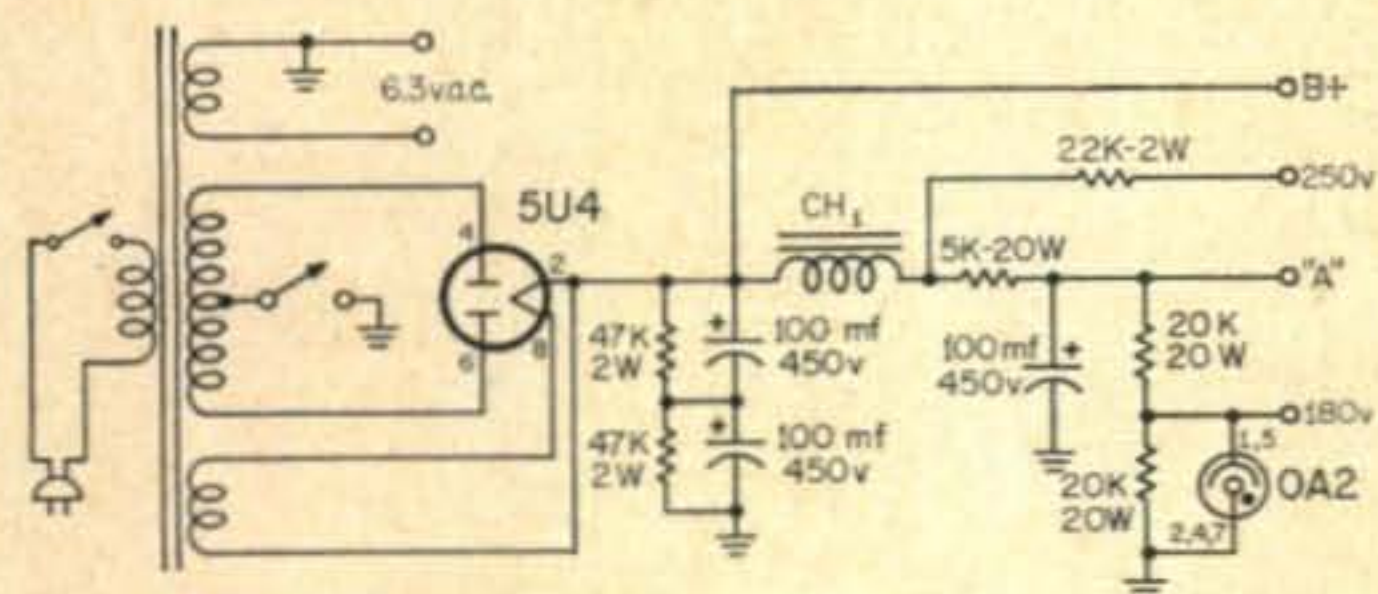
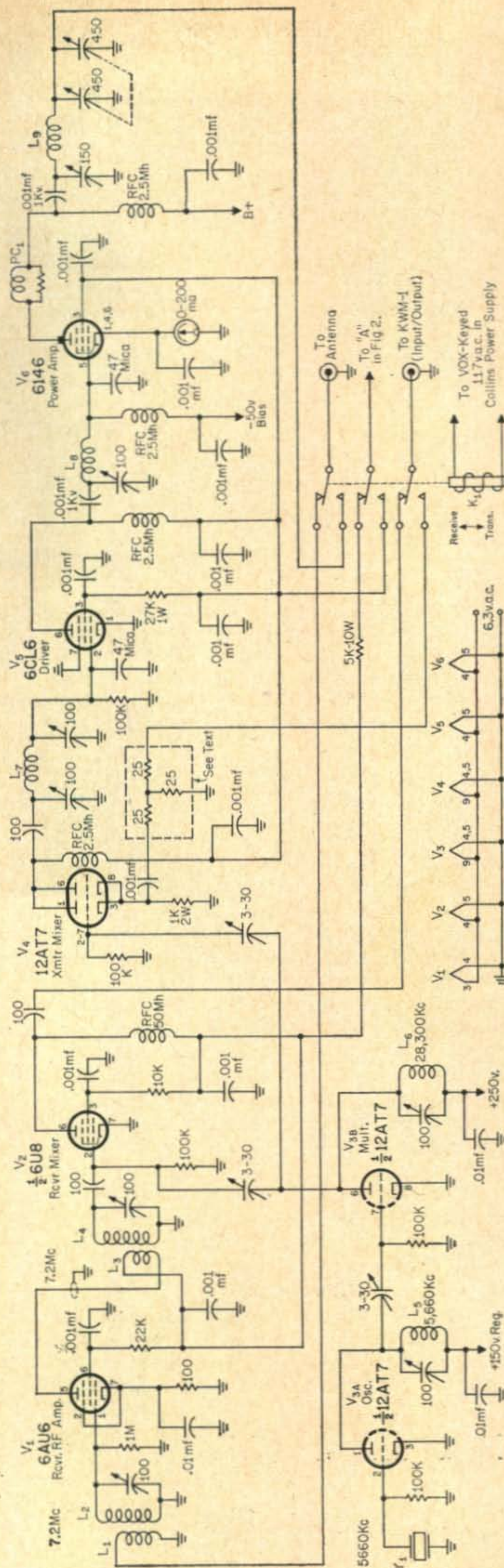


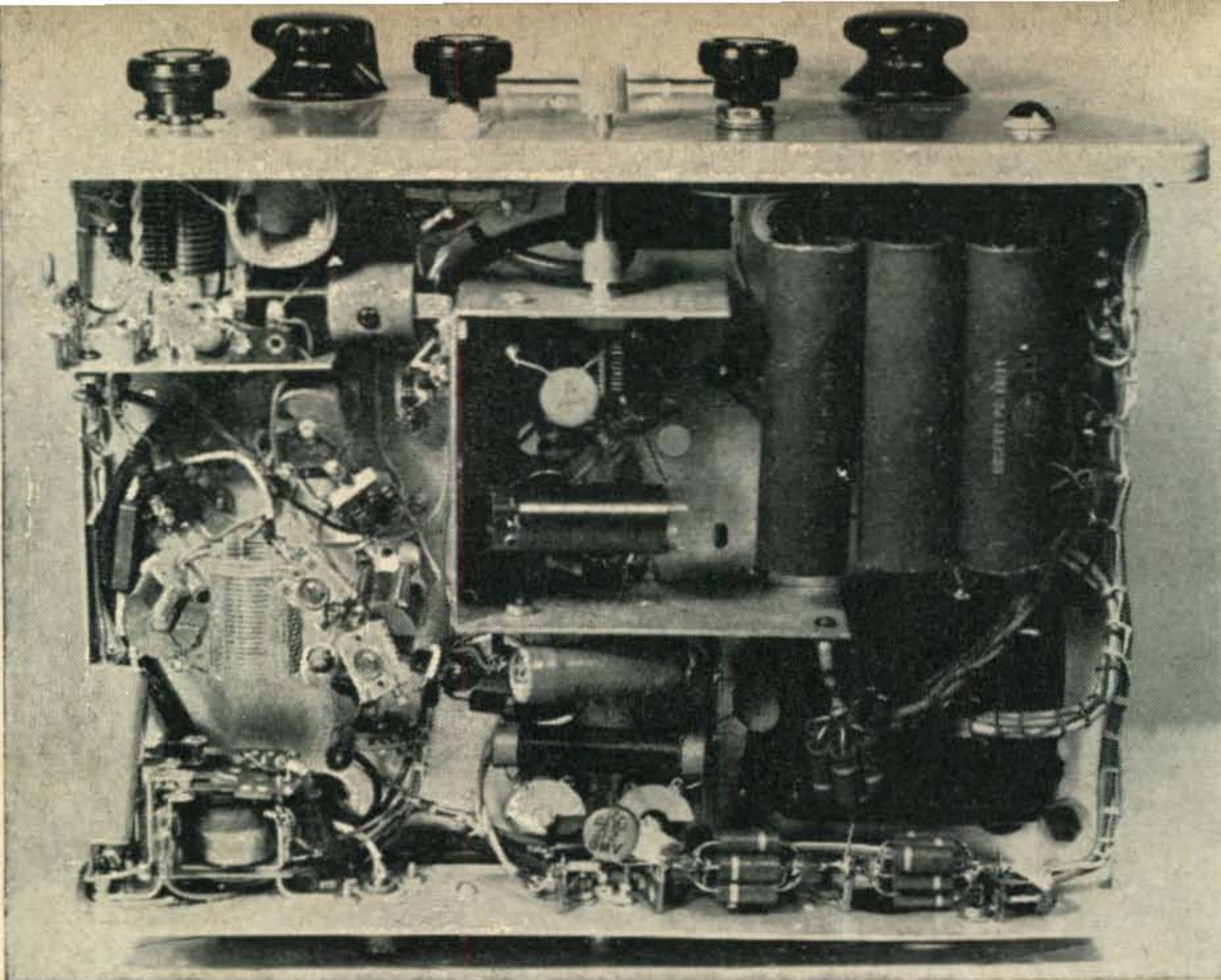
Fig. 2—Schematic of a power supply providing the various voltages necessary for the 40 meter KWM-1 adapter.

T<sub>1</sub>—800 v.c.t. 200 ma, 5.0 v. 3 a., 6.3 v. 5 a. Stancor  
PM-8412.

The relay  $K_1$  performs a variety of functions and does a fine job of permitting transceive operation. It serves to apply the proper power supply voltages to the "Heterodyner" when the loads change during the shift from receive to transmit. The voltage to energize  $K_1$  is taken from the Collins power supply. It is 117 v.a.c. keyed by the vox.







Bottom view of the Heterodyner showing parts placement. Inductors  $L_1$  and  $L_2$  are in the upper left hand corner along side the receiver R.F. Tuning. The rotary on-off switch is to the left, on the panel. Inductor  $L_5$  is located behind  $L_1$ . Inductors  $L_3$  and  $L_4$  are just above the relay,  $K_1$ . Inductor  $L_6$  and the driver tuning capacitor are located in the U shaped shield while  $L_7$  is between the shield and the rear flange. The input swamping network may be seen just above the power transformer. A bias pot is located to the right of the Driver Tuning, on the front panel.

### Stability

The stability of the Heterodyner is dependent upon the 28,300 kc oscillator. It was for this reason that a 5,660 kc crystal was used and multiplied up to its fifth harmonic. Originally, a 28,300 kc overtone crystal was used and on-the-air reports indicated a few cycles difference between the receive and transmit frequencies. The circuit shown will provide perfect transceive operation. I obtained two surplus 5660 kc crystals and found their frequencies to be slightly off. Of the two, one was very active while the other was sluggish with the applied 150 volts. Do not increase the applied voltage or the crystal oscillator might drift due to crystal heat. It is safer to use an active crystal.

A pair of 6146 tubes in the final may be used rather than one as the power supply components employed could easily handle them. The coupling between the mixer, driver, final and the antenna is the familiar pi-network configuration. This tends to prevent strays, birdies and wild oscillations.

The KWM-1 input to the transmitter mixer,  $V_4$ , is fed through a swamping network made up of eighteen 150 ohm 2 watt resistors. Each leg of the network has 6 parallel resistors. The network presents an excellent impedance match for the KWM-1 and acts to reduce the input to  $V_4$  to a safe level.

### Construction

So you're ready to get on 40 meters in a hurry. Well, if you are not too inexperienced, it

can be accomplished in no time at all. For those of you that are not too familiar with the building of heterodyne units, you had better enlist the aid of some old timer who is "hep" on such matters. These little heterodyne units can be real little demons if they are not properly tuned. You must have the following test equipment: a grid dip meter, a vacuum tube voltmeter with an r.f. probe and a certain degree of patience.

The Heterodyner, as shown in the photographs, was built on a defunct DX-40 chassis. The physical size was just about right for my requirements and many of the existing components of this unit were used. The power supply, driver stage and final amplifier are all conventional, and no difficulty should be encountered with their construction.

### Receiver Tune Up

With no power on, grid dip  $L_2$  to 7,200 kc,  $L_4$  to 7,200 kc,  $L_5$  to 5,660 kc and dip  $L_6$  to 28,300 kc. Turn the power switch on and let the tubes warm up. Apply the plate power and, with the KWM-1 in the receive position on 21,100 kc, a slight amount of noise (or a signal possibly) will be heard.

Using a v.t.v.m., check  $V_{3A}$  to be sure it's oscillating. Adjust  $L_5$  for stable operation by turning the plate power on and off a few times. Move the v.t.v.m. to pin 2 of  $V_2$ , the 6U8 mixer, and adjust  $L_6$  for maximum bias voltage.

Adjust the 100 mmf capacitors across  $L_2$  and  $L_4$  and the two 3-30 mmf coupling capacitors.  
[Continued on page 118]



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found that nearly 4,000 QSOs were entered in the log representing all Continents and about 70 Countries.

Several firsts were made during our stay on the Island; The principal one being a birthday celebration for our club president Goyo. We gave him a nice party one night and it was the first celebration of this kind on the Island. The second one was the first phone patch on the Island. Field telephones were installed between the three camps and one morning at about 8:00, the a.m. camp rang the bell and told us that Susan, YV5AFF, Goyo's wife, was calling him on a.m. The phone patch was made by putting the mike over the telephone and vice versa and the first telephone call from the Island was made!

One final word about the rigs and antennas. The c.w. camp used a Johnson Valiant and Ranger. The antenna was a long wire and receivers were a Drake 2B and Hammarlund HQ-170. The s.s.b. camp used a KWM-2 with an auxiliary p.t.o. and a B&W 5100B with 51-SB sideband adapter and a Collins 75A-4 was also used. The antennas consisted of a TA-33 and TA-2.

The a.m. gang used a Hy-Gain vertical and several dipoles with a complete Harvey-Wells rig, including transmitter, receiver and Z-match. A Heath Apache and Hammarlund HQ-170 were also used at the a.m. station. All three camps used Onan power generators. An effort was made to use all bands from 80 to 6 but conditions were extremely poor on both 10 and 6 meters during our stay on the Island.

Heavy seas made transfer to the Destroyer difficult and many of our rigs were given a severe dousing of salt water. About three hours later, everything was safely aboard the *Aragua*.

We were a sad looking bunch upon our return to Lagunaira; dirty, unshaven, covered with bird droppings, salt, mud and peeling skin but we were all very happy. All of us, the gang from YV0AA, would like to thank the Venezuelan Navy for its cooperation and, of course, all the stations contacted for their help in making the Aves Island DXpedition a success. We hope we will meet you all again from this same rare spot sometime soon. ■

### KWM-1 Adapter [from page 34]

itors in the oscillator section for optimum performance. This can be judged by either noise or a signal. Forty should now be as hot as a firecracker.

### Transmitter Tune Up

With  $K_1$  energized, check the static plate current of the 6146. With 50 volts of bias it should range from 25 to 30 ma. De-energize  $K_1$  and tune up the KWM-1 in normal fashion, raising the mike gain for some carrier insertion to the Heterodyner. Using a v.t.v.m. and an r.f. probe, check at the swamping network for



the presence of r.f. Keep the level low so as not to overdrive  $V_4$ . Adjust the pi network in the plate of  $V_4$  for maximum output on 7,210 kc. Use a grid dipper, in the wavemeter function, tuned to 7,210 kc and coupled to  $L_7$ , as an indicator. It would also be best, at this time, to adjust the 3-30 mmf trimmer between  $V_{3B}$  and  $V_4$  for maximum output as shown on the g.d.o.

Next, tune the driver stage,  $V_6$ , and keep an eye on the plate meter. Don't let the 6146 run wild. Tune the driver for maximum output as indicated by the g.d.o. coupled to  $L_8$ .

Dip the final plate and load out to 150 ma with the plate dipped as the last adjustment. Set the KWM-1 for sideband operation. The 6146 plate current should drop back to 25 or 30 ma. Adjust the KWM-1 mic gain to where voice peaks kick the adapter meter up to about 75 ma. Don't get ambitious at this point and start a flat-topping operation. This adapter is the same as any other s.s.b. rig and will put out a bad signal if driven too hard. So, for Pete's sake, keep that "à la Collins" quality that you have there. You will note that your ALC will just barely flicker when the correct amount of drive is being used. Take a look at the voltage regulator,  $V_5$ , and be sure it stays ignited when switching from receive to transmit.

### Conclusion

You have probably concluded by now that I am not a literary genius, but I do hope all who demanded that this article be written have enough to get started on a real worth while project. You have heard the signal on the air and know that it sounds like a million bucks. I used the Heterodyner barefoot for a while, but am now driving a 700 watt grounded grid linear and am having a ball on a mighty fine band. See you on 40. Maybe we should try for 80 . . . ? ? ? ?

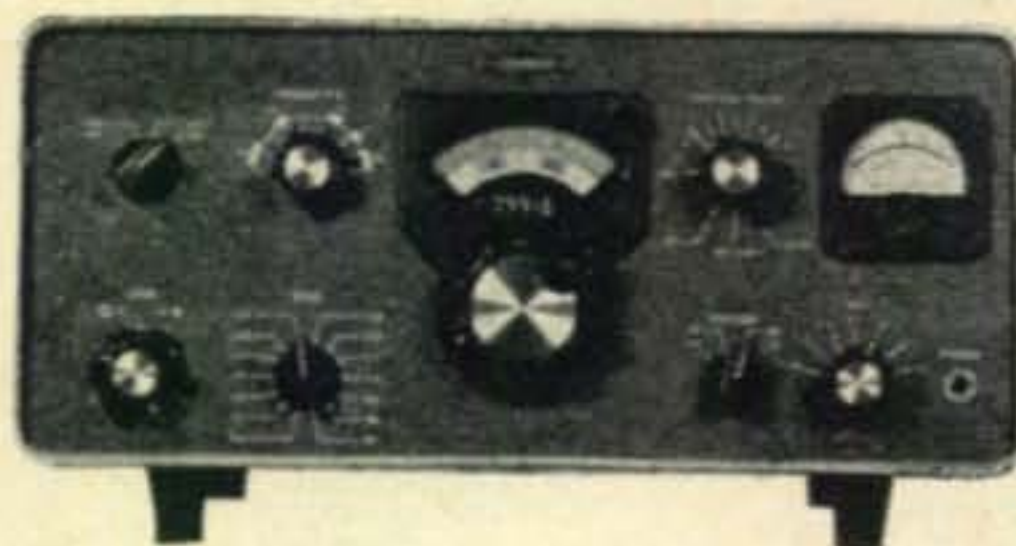
**One Tube, 30 Watts** [from page 27] on the fundamental frequency. If you have trouble getting the circuit oscillating, try several crystals as you may have a bad or sluggish crystal.

When the 50 ohm antenna is connected in place of the lamp bulb, the tuning will have to be touched up as there is a change in impedance. A good way to tune is by watching a field strength meter and note the maximum output.

Now that the transmitter is finished you may feel as I did; I wished I had built it last year for this years vacation. I kept putting it off until vacation time was here and then it was too late to haul it along. My advice to all portable rig luggers is to size up next year's vacation trip and plan now. Build it before you need it. You'll find, when you go on a trip, it will be handy to have in case you have to radio home for more money.

**Terry (W9DIA) Says . . .**

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