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Two'er Talk

During the past 4 years, I have had occasion to chat on 144 mc with several stations using Heath TWOers. Some of these useful little transceivers deliver excellent results for their owners. There are, however, a number of these TWOers which are suffering from transmitter instability, TVI, bassy audio, abnormally low output and audio distortion. A few of these ills are caused by poor workmanship when the kit was assembled. The bulk of the ailments mentioned result from engineering problems which can quite readily be corrected.

Numerous articles have been written and dedicated to circuit modification of these handy little portable packages. Little has been said about the more predominant problems which exist in them. Some of these articles described the addition of push-to-talk relays, panel meters, squelch circuits, etc. The basic ailments which relate to efficient operation have not been presented. While sitting back on the sidelines, watching many of the fellows struggle with these common problems, I decided to acquire a TWOer of my own and attempt to resolve these more troublesome circuit bugs. After studying the circuit diagram, applying standard procedures and sweating over a moderately hot soldering iron for a short period of time, I ended up with a TWOER which possessed all of the attributes common to a well engineered VHF transmitter.

Analysis

The final tank circuit could be modified to provide much greater efficiency and reduced TVI.

The P.A. stage would no doubt benefit from neutralization inasmuch as both the driver and P.A. are in a common envelope, operating on the same frequency.

Capacitor values in the speech amplifier and modulator stages could be changed to reduce bass response and give the signal greater "punch."

High level-negative peak clipping could easily be added, to further increase audio punch and aid in the elimination of possible "overmodulation."

Conventional coax fittings could be added to the rear apron of the TWOer, to facilitate use with other station equipment and antenna feedlines.

Removal of the diode metering circuit could prevent bleeding of rf power from the transmitter output and reduce TVI caused by the harmonic action typical with diodes.

With great enthusiasm, the above changes were made. The results were well worth the small amount of effort.

The Modifications

P. A. Tank–Replace the final amplifier tank coil with 4 turns of #12 wire, ½" in diameter × 1" long. (Silver plate if possible.)

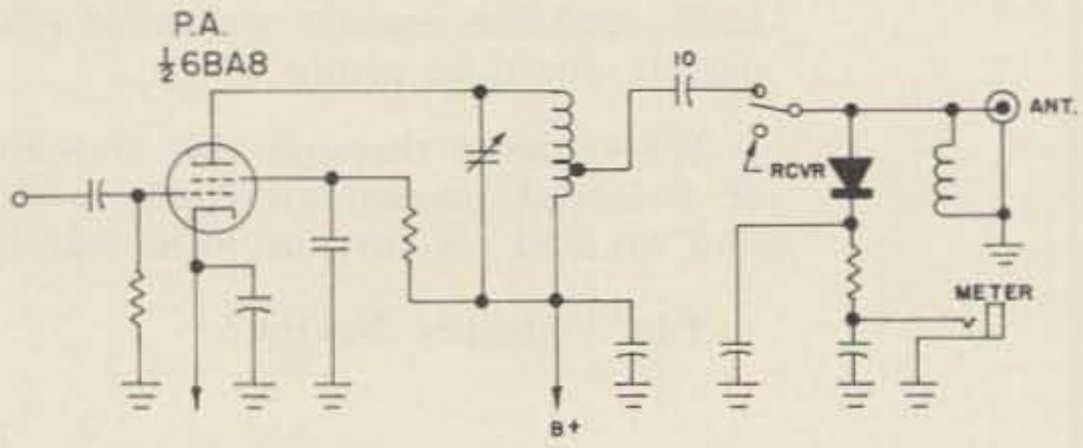

FIG. 1-A

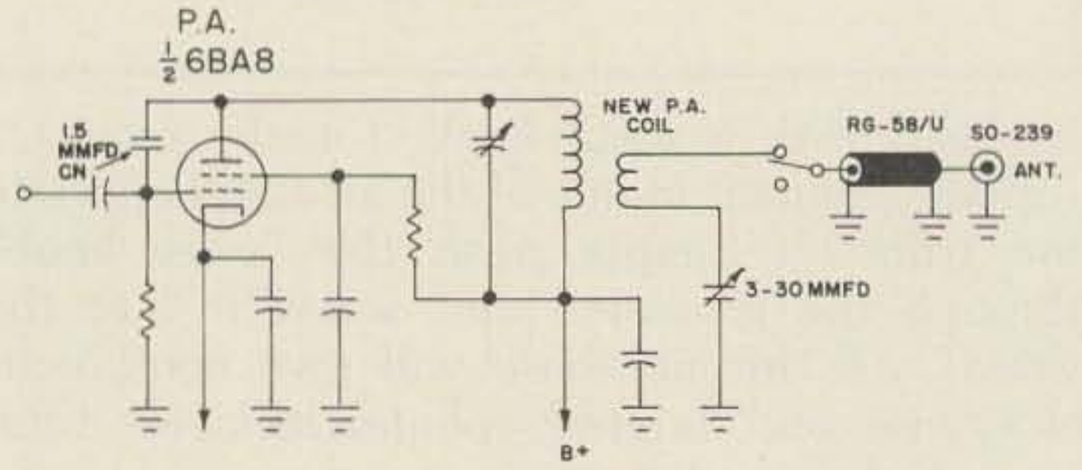

FIG. 1-B

Remove the 10 mmfd output coupling capacitor from the P.A. Tank coil. (This will reduce TVI and permit a better match to the feedline.) Replace the capacitive output circuit with a 2 turn link of #20 formvar or nyclad wire, inserted in the B+ end of the new tank coil. (Make certain the link is wound in the same direction as the tank coil.) Return this new link to ground through a 3-30 mmfd mica trimmer. This will be used to effect a proper match to the feedline and reduce reactance.

Replace the bus wire connecting the antenna fitting to the TRANSMIT-RECEIVE switch with a short length of RG-58/U coaxial cable. Be sure to ground the shield at both ends of the new cable. (See Fig. 1-B.) This further improves feedline matching and circuit isolation.

Neutralization of the P.A. Stage–Due to the self neutralization frequency of the 6BA8

P.A. tube, it became necessary to employ POSITIVE neutralization. This is actually less complicated than the conventional methods of neutralization. Add a 1.5 mmfd ceramic capacitor from pin 7 to pin 9 at the tube socket, keeping the pigtails as short as possible.

This modification eliminated all signs of instability, cleared up all signs of FM, downward modulation and audio distortion and roughness. TBI was further reduced until it could no longer wipe out channel 7. Faint cross hatch remained. (See Fig. 1-B.)

Replace the .01 mfd coupling capacitor between the 12AX7 plate pin and the 6AQ5 control grid, with a .005 mfd disc ceramic. Replace the 25 mfd cathode by-pass electrolytic on the 12AX7 stage, with a 10 mfd 25 volt unit. Replace the .01 mfd 3 KV by-pass condenser connected from the modulation transformer tap to ground, with a .005 mfd 3 KV ceramic unit. These changes resulted in better high frequency characteristics in the audio system. Readability under weak signal conditions was improved. (See Fig. 2-B.)

Clipping—There is no audio gain control for the modulator. This means that it is necessary to remain a proper distance away from the microphone to prevent "overmodulation." This can be a source of annoyance when operating mobile. This extra audio which is available, can be put to use in the form of "clipped modulation" which will increase the weak signal readability of the transmitted signal. To add this High Level Negative Peak Clipping, simply add a 500 ma top hat type silicon diode to the modulator output circuit, as shown in Fig. 2-B. You can now "move in" on the mike without fear of distortion, etc.

Antenna Fittings—Replacement of the present antenna connector with a standard SO-239 chassis type receptacle, will permit use with standard cables and other station accessories. This is easily done by enlarging the existing mounting hole with a ⅝" chassis punch.

Metering Circuit—In some TWOers I have tested I discovered that the metering diode and allied circuitry bled a portion of the rf output energy away from the feedline. Removal of the entire network increased the transmitter output considerably. In addition, the metering diode encouraged harmonic output, which in turn contributed to TVI. Once this circuitry was removed, the remaining TVI disappeared. Without this metering provision, it becomes necessary to tune up by a different means. In my case, I tune for maximum forward power as noted on my SWR bridge. This should be no handicap, inasmuch as most well equipped VHF stations have an SWR bridge as standard bill of fare.

Conclusion

Before modification of the circuitry, as noted above, the measured output of the TWOer was .78 watts. Similar readings were taken with other TWOers. Following modification, the output increased to 2.4 watts into the same dummy load. No trace of TVI could be found. Prior to modification, channel 7 was wiped out. Reports of excellent audio quality and quantity were received following the circuit changes.

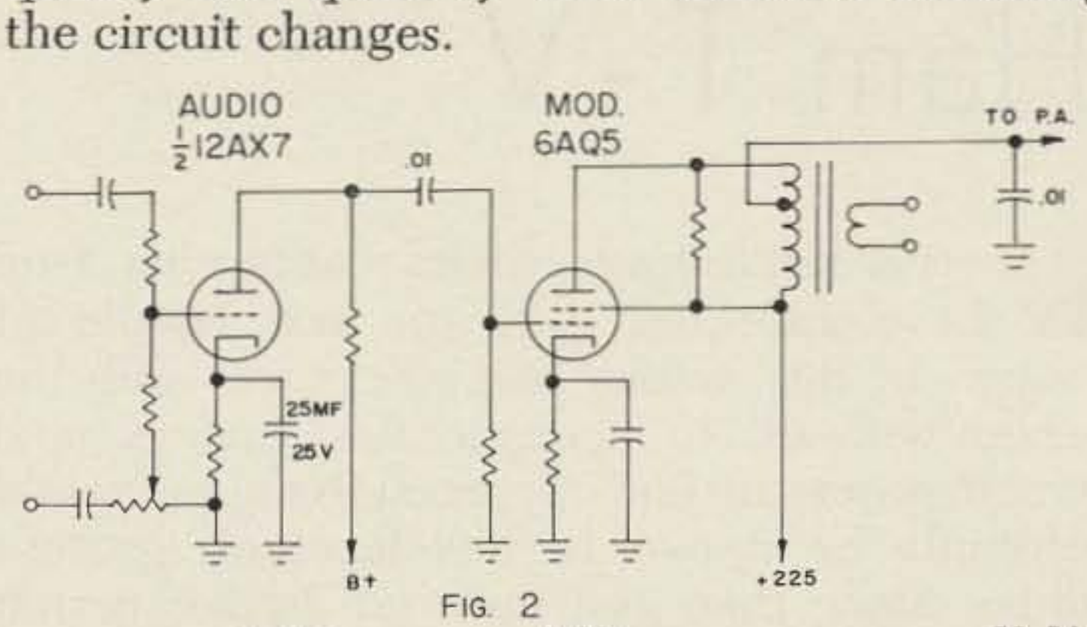

FIG. 2

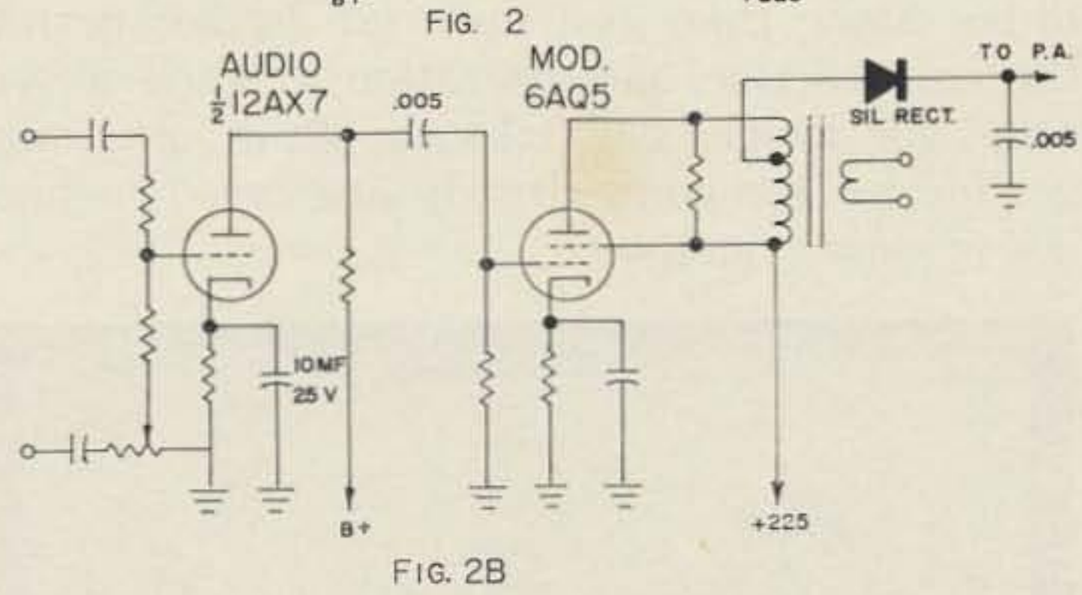

FIG. 2B

Regardless of the manner in which the multiplier stages and the P.A. are tuned, no instability would occur. Audio distortion and downward modulation completely disappeared.

Other refinements could have been made to the TWOer, but the ones mentioned in this article were of greater importance.

No changes were necessary in the receiver portion of the transceiver. Having built several regen type 2 meter receivers, I must say that the one contained in the Heath TWOer is the best I have seen in such simple circuitry. It is stable, sensitive and exhibits no "dead spots" in the tuning range.

With my modified TWOer, I have been able to work considerable distances over the rough terrain common to Northwestern Lower Michigan. I am using stacked A-62 Finco antennas on a 75 foot tower and feeding them with low loss balanced feedline and a VHF type Matchbox. I have been able to hold regular Q-5 schedules with WA9DOT in Grafton, Wisconsin. The distance is 165 miles, airline. Other similar contacts have been made without the aid of band openings.

Good luck on your TWOer changes!

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