

The Knight-Kit T-150 Transmitter

BY WILFRED M. SCHERER*, W2AEF

PROBABLY the best introduction to the Knight-Kit T-150 is to simply say that it is a lot of transmitter for the money.

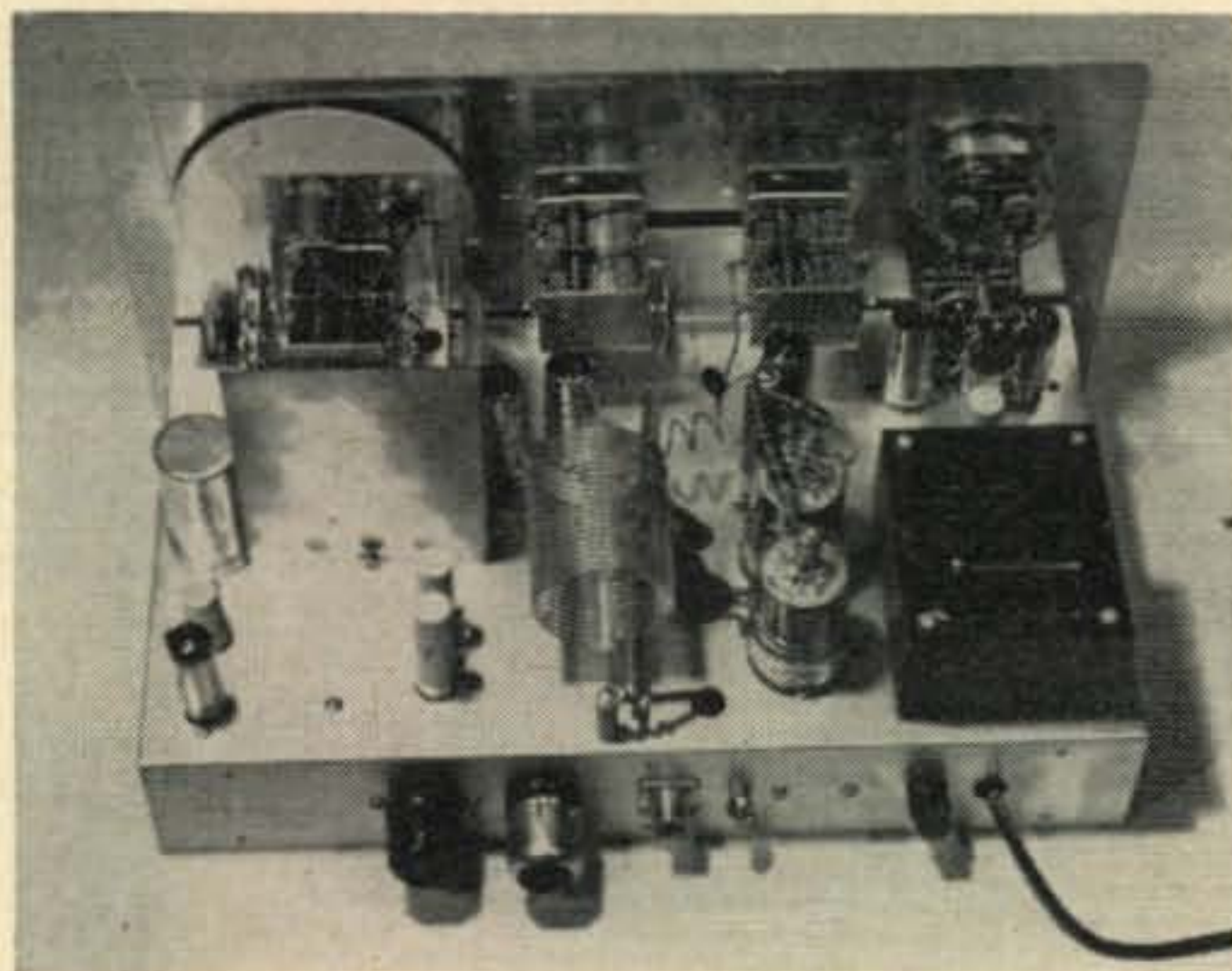
Take a look at some of its features: A pair of 6146's in the final amplifier with pi-network for working into 40 to 600-ohm loads; input power 150 watts c.w., 150 watts peak a.m., on all bands 3.5 to 28 mc; 100 watts in both modes on 50 mc; stable v.f.o. with illuminated dial nicely calibrated for each band; provision for crystal control; shock-proof key terminals; band-switching; frequency-spotting position; TVI-suppression measures; full meter switching; regulated potential for v.f.o.; rear power plugs for separate accessories, auxiliary controls and use of external high-level modulator; rugged construction with high-quality components used throughout; built-in power supply using solid-state rectifiers; all housed in a cabinet measuring only $8\frac{1}{2}'' \times 17'' \times 10\frac{1}{2}''$.

In addition, the whole unit is so attractively designed, that it is a piece of equipment well suited for table-top operation in almost any type of home environment. Its wrap-around cabinet is gray hammertone, the panel is a two-tone combination of light gray and charcoal with mirror-finish trim and the knobs are black with polished aluminum inserts. Both the meter and the v.f.o. dial scales are black with white numerals.

Circuit Description

A 12BY7 is used for the v.f.o. in a series-tuned oscillator circuit. The v.f.o. operates on 3.5 mc for 3.5 mc band use, on 7 mc for 7, 14, 21 and

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Rear chassis view of the T-150. V.f.o. components are mounted forward of the shield partition and the power resistors are mounted behind for ventilation. Auxiliary power plug, antenna connector, heavy ground terminal with wingnut and fuse are mounted on the rear apron.



Front view of the Knight-Kit T-150 transmitter. Two 6146s are in the final, covering 80 through 6 meters.

28 mc band use, and on 8.3 mc for the 50 mc band. The v.f.o. is followed by a 6CL6 which is used either as a buffer amplifier, frequency multiplier or Pierce crystal oscillator. When it is used for the latter, the v.f.o. is disabled. The next stage utilizes a 7189 as an amplifier or multiplier. This tube is a newcomer to amateur transmitters and it packs a good punch as is evidenced by the more than ample grid drive which is available to the final in the T-150. The final amplifier consists of a pair of 6146s connected in parallel and using the familiar pi-net output circuit.

C.W.: The cathodes of all r.f. stages are keyed along with the v.f.o. for c.w. making break-in operation possible. A 2200 ohm resistor is shunted across the key jack to prevent excessive voltage at the key. It also provides a bias to cut off the v.f.o.

A.M.: On a.m., cascaded halves of a 12AX7 are used for the speech amplifier with high impedance input for crystal, ceramic or Hi-Z dynamic microphones. An r.f. filter at the input reduces the possibility of r.f. feedback. Two sections of a 6DR7 dissimilar triode are then combined to modulate the final-amplifier screens and to provide a controlled carrier during the modulation process.

POWER SUPPLY: A saving of space and the reduction of heat generation within the cabinet is made possible by the use of silicon rectifiers in the power supply. Costs are also held down by the utilization of a voltage-doubling circuit. Six-hundred and forty volts (at full load) is available for the 6146s, while a tap at the midpoint of the voltage-doubling scheme furnishes 320 volts for the low-power stages. An 0A2 tube provides 150 volts of regulated potential for the v.f.o. and the screen of the 6CL6. A power plug at the rear of the chassis makes available, for accessory use, 640 or 320 volts d.c. at 50 ma and 6.3 v.a.c. at 1 a. A second plug at the rear makes

[Continued on page 77]

Knight-Kit T-150 [from page 41]

it possible to connect an external high-level plate modulator without necessitating any rewiring in the transmitter.

METERING: The panel meter may be switched to read BUFFER-GRID, AMPLIFIER-GRID and PLATE currents. A position is also provided to read relative r.f. output power. This is an especially nice feature which facilitates tuning for the most output, serves as an output monitor or may be used as a neutralizing indicator.

FUNCTION SWITCH: The following modes are controlled by the Function Switch: POWER OFF; V.F.O. SPOT; A.M.; STANDBY and C.W.

Assembly

Parts identification is readily made by Knight-Kit's usual method of packaging the resistors mounted on cards together with individual identification. This is a feature which saves a great deal of sorting and time. In addition, a photographic parts-identification sheet aids in the selection of not only the correct electronic component, but also in the various pieces of hardware. Pre-cut and trimmed hook-up wire, which is color-coded for different lengths, also is an added convenience.

A 36-page Assembly Manual provides complete instructions which are concisely given, and if the instructions for each step are carefully and completely read, no special problems will arise and the unit may be assembled in 18 to 20 hours.

The schematic diagram should be corrected to read: FUNCTION switch in OFF position.

Alignment and Tuneup

Three easy methods of v.f.o. alignment are set forth in the Manual.

Tune-up first involves adjusting for grid drive to the final. Desired meter readings are not given in the manual, but our experience indicates that about 3 ma is about right. As a protective measure, the final then is initially tuned for maximum output using the A.M. position. After this, it is again tuned for the best output, but this time in the C.W. position. This is the procedure for *both* c.w. and a.m., since the peak a.m. output depends on that obtainable on c.w.

Tuning up is a simple procedure which relies on the maximum obtainable power output (indicated on the relative power meter) from the final amplifier rather than depending on the resonant dip at rated plate current, as generally is done. This may seem a bit unusual; nevertheless, it is a good procedure, since coincidence of plate-current dip and maximum output does not always occur with tetrodes and should cause no undue concern as long as the amplifier otherwise exhibits stability. The lack of coincidence will especially be noticed when the T-150 is used on 3.5 and 7 mc.

The plate current for c.w. operation will be approximately 250 ma except on 50 mc, it will be 175 to 200 ma. With a.m. the resting current

will be about 100 ma which, during modulation will kick up 60 to 70-percent of the c.w. current. The output-power meter reading also will similarly rise.

Performance

The first delivered T-150s exhibited a number of faults; however, these may be overcome with a modification kit¹ which provides several shields and a number of component and circuit changes. Application of these to the unit under test eliminated most of the early difficulties.

With c.w. on 3.5 and 7 mc a tendency toward some chirp and roughness of the signal was experienced, the extent of which depends on the tuning of the low-power stages. Some frequency modulation also was found with a.m. This is mainly due to the fact that the v.f.o. functions on the same frequency as one or more following multiplier stages. The only sure-fire cure is to operate the v.f.o. on a lower frequency. Fortunately, the T-150 has a separate v.f.o. range switch, so that when 7 mc operation is conducted, the v.f.o. may be switched to its 3.5 mc range, in which case the output frequency will be a multiple of the dial calibrations on the 3.5 mc scale. This will cure the problem. (Such operation may be used for the higher bands also).

This cannot be done, without modifications, for 3.5 mc band use, so the next best bet is to adjust the tuning of the low-power stages for the best sounding signal.

V.f.o. stability was found to be excellent both electrically and mechanically. Required warm-up up time for 3.5 mc was 15 minutes; for 7 mc, 30 minutes.

The final tank capacitance for 21 and 28 mc was found to be a bit high. This was corrected by moving the coil taps to *add* an additional turn for each of these bands. This resulted in increased output and less tank heating. Difficulties were encountered in properly matching to loads below 100 ohms on the 3.5 and 7 mc bands. This was corrected with a more favorable L/C ratio for 7 mc by moving the coil tap *down* two turns (*less* inductance).

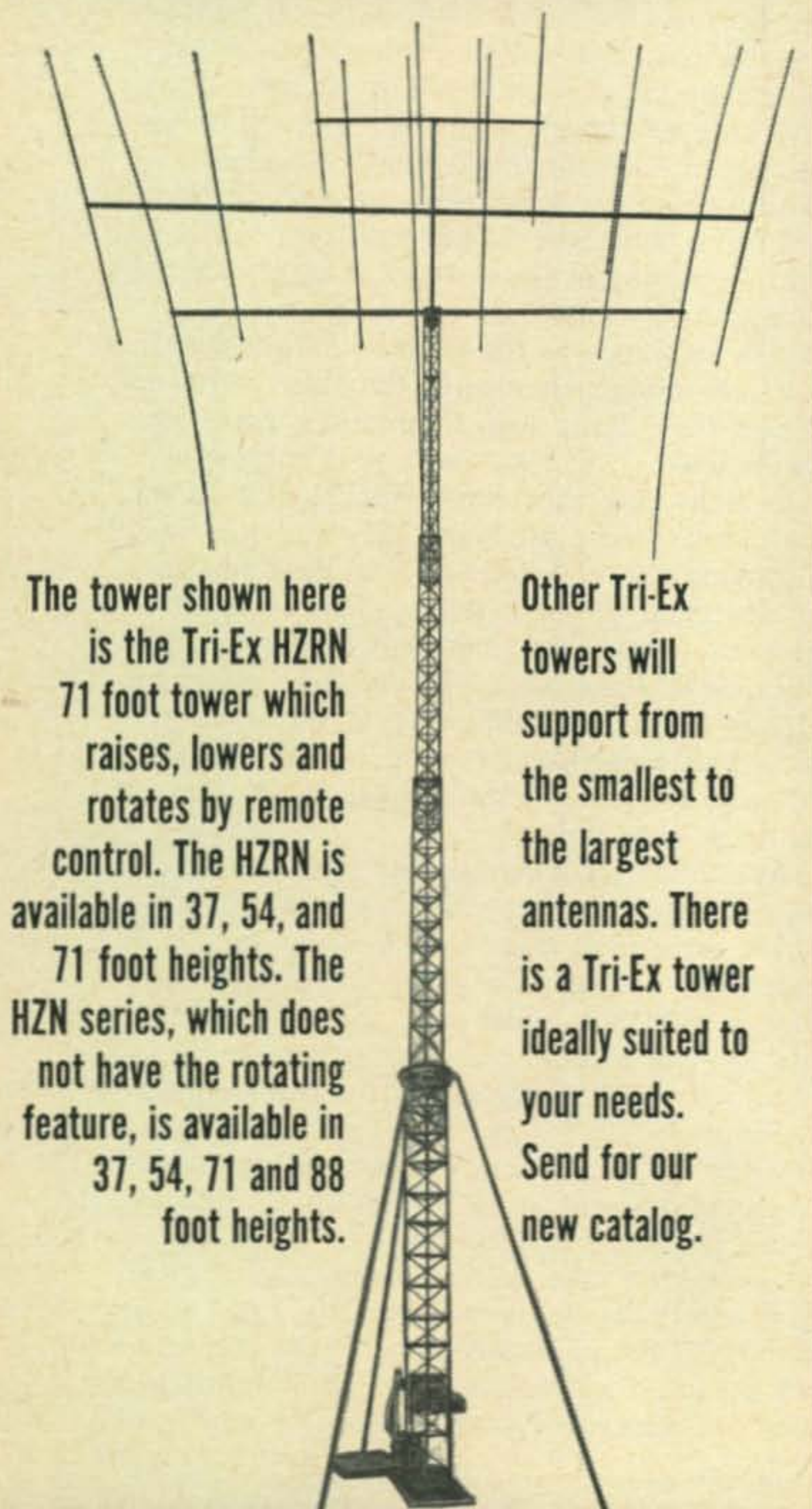
The 3.5 mc inductance can likewise be cut down, but this requires switching in a capacitive padder across the plate-tuning capacitor. It is interesting to note that when these steps were taken in the unit under test, that full loading with low-impedance was readily obtained together with coincidence of plate-current dip and maximum output.

POWER OUTPUT: The output ratings specified in the manual are: 90 watts on 3.5 through 21 mc, 55 watts on 28 mc and 40 watts on 50 mc. After the tank changes, just given above, were made, and with the final plate loaded to 250 ma, at which point the measured plate potential was 640 volts for an input of 160 watts, the measured output in a 50-ohm load

¹Available free of charge to owners of original kit. Request for modification kit #040159 should be made to Allied Radio Corp., 100 N. Western Ave., Chicago 80, Ill., giving date of purchase of original kit.

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Note: ENTIRE TOWER ROTATES!!



The tower shown here is the Tri-Ex HZRN 71 foot tower which raises, lowers and rotates by remote control. The HZRN is available in 37, 54, and 71 foot heights. The HZN series, which does not have the rotating feature, is available in 37, 54, 71 and 88 foot heights.

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was: 110 watts on 3.5, 7 and 14 mc, 105 watts on 21 mc and 90 watts on 28 mc. Output on 50 mc was a little under 40 watts.

MODULATION: As is common with modulation systems of the type used, the r.f. envelope is never quite fully modulated, however, due to controlled-carrier action modulated power is favored in the positive direction which results in both a high average and peak power.

Excellent quality is obtained with the T-150 and the measured tone-modulated peak power was found equal to the c.w. power, while during noise modulation the short instantaneous peaks actually exceeded this value slightly due to the regulating action of the power supply filter.

In order to avoid flat-topping with distortion and splatter a good procedure for adjusting the modulating level (if a scope is not available) is to set the output power meter reading to full scale during c.w. tune-up, then using the a.m. position, talk into the microphone and adjust the mike gain so the highest voice peaks kick the meter no more than to between 4 and 7.

TVI: Measurements indicated some harmonic radiation along the edges of the panel, in the vicinity of the meter and at the v.f.o. dial window. Most of this is due to the fact that the panel is not bonded to the cabinet, the only contact between transmitter and cabinet being made at the rear where the two are secured together with screws. Nevertheless, in the strong signal area in which tests were conducted, little difficulty was experienced; but in weak signal areas, good bonding between the panel and cabinet would be required and, of course, a low-pass filter in the transmission line should be used.

All-in-all, one cannot help but be well pleased with the T-150. No doubt, it will set a pattern for a move towards higher-powered units of a similar nature. Priced at only \$119.50, the Knight-Kit T-150 will be found a wise investment. Incidentally, the Knight-Kit R100-A receiver is also available with styling to match the T-150. ■

Novice [from page 54]

suppress harmonics. All components should be laid out to keep r.f. lead lengths to a minimum. This is important, not only for the purposes of keeping the resonances of the grid-to-cathode and the plate-to-cathode paths above the TV bands, but also because it helps discourage v.h.f. parasitic oscillations. Link coupling should preferably be used throughout the transmitter. Link coupling discriminates against the passing of harmonics from one stage to another, and helps to keep all leads short.

Complete electrical shielding of the whole transmitter prevents radiation of harmonics. Be sure to connect the metal cabinet of the transmitter to an earth ground, keeping in mind that the ground lead should not be a multiple of a quarter wave at the frequency of operation. A good ground is also a safety measure.

Keeping all frequency multiplier output as low

For further information, check number 55, on page 110