transistorized free running multivibrator generating a square wave signal at an audio frequency rate rather than the conventional audio sine wave oscillator that is normally used for code practice. The multivibrator produces a higher amplitude output than is ordinarily obtained from the same transistors generating a pure sine wave. The square wave signal has a higher harmonic content, resulting in a crisp tone very closely resembling the output of a communications receiver tuned to a good CW signal.

The capacitance coupling between the two transistors cause them to alternately switch from a heavily conducting to a non-conducting state. Transistor Q1 going into conducting will cause Q2 to be cut off for a definite period of time and vice-versa. The rate of switching (the multivibrator frequency) is determined by the resistance (20K) and capacitance (.05) of the circuit. The values given will cause the frequency to be in the proper audio range.

The unit is housed in a 2¼″ x 2¼″ x 4″ aluminum mini-box. Two phone jacks are mounted on the box, one for the key and one for the headphones. The "chassis" is a terminal strip 2″ wide and with six sets of terminals. All the components were mounted and soldered. The two terminals on one end were bent in slightly to hold the battery in place. The "chassis" was mounted on ½″ insulated stand-offs and then secured to the mini-box. An Eveready #504 (15 volts) was used three to four hours a day for a week and showed no appreciable drop in the volume.

Rummaging around in the junk box, we came up with a small speaker with an output transformer which we hooked in place of the phones. The volume was enough for the unit to be used in a 9 x 12 room with five people copying code.

. . . W3JYL & W3RRV

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The Knight-Kit T-150

a test report

AT THE RISK OF HAVING the Hon. Ed. shake his old gray head in dismay over the corruption of the younger generation, I must admit that the Knight T-150 transmitter kit appeared this summer just in time to cause me to shelve plans for a home brew 150 watt rig at K9PWT. Since the T-150 is a new piece of equipment and is not yet too widely known, I have prepared a table of condensed specifications which appears elsewhere in this article.

The rf circuitry begins with a 12BY7 in a Clapp VFO, developing output voltage across one of three tank circuits: 3.5 mc (80M), 7.0 mc (40-10M), or 8.3 mc (6M). The next stage is a 6CL6 buffer which also serves as a modified Pierce oscillator when crystal control is desired. In this case the 12BY7 is disabled and 3.5, 7.0, or 8.3 mc crystals used.

Next in line is a 7189 buffer/multiplier stage driving a pair of neutralized 6146's in parallel. All rf stages are cathode keyed for CW operation. A 2.2K bias resistor connected across the key jack keeps high voltage off the key terminals and allows current to flow during key-up periods, stabilizing the power supply.

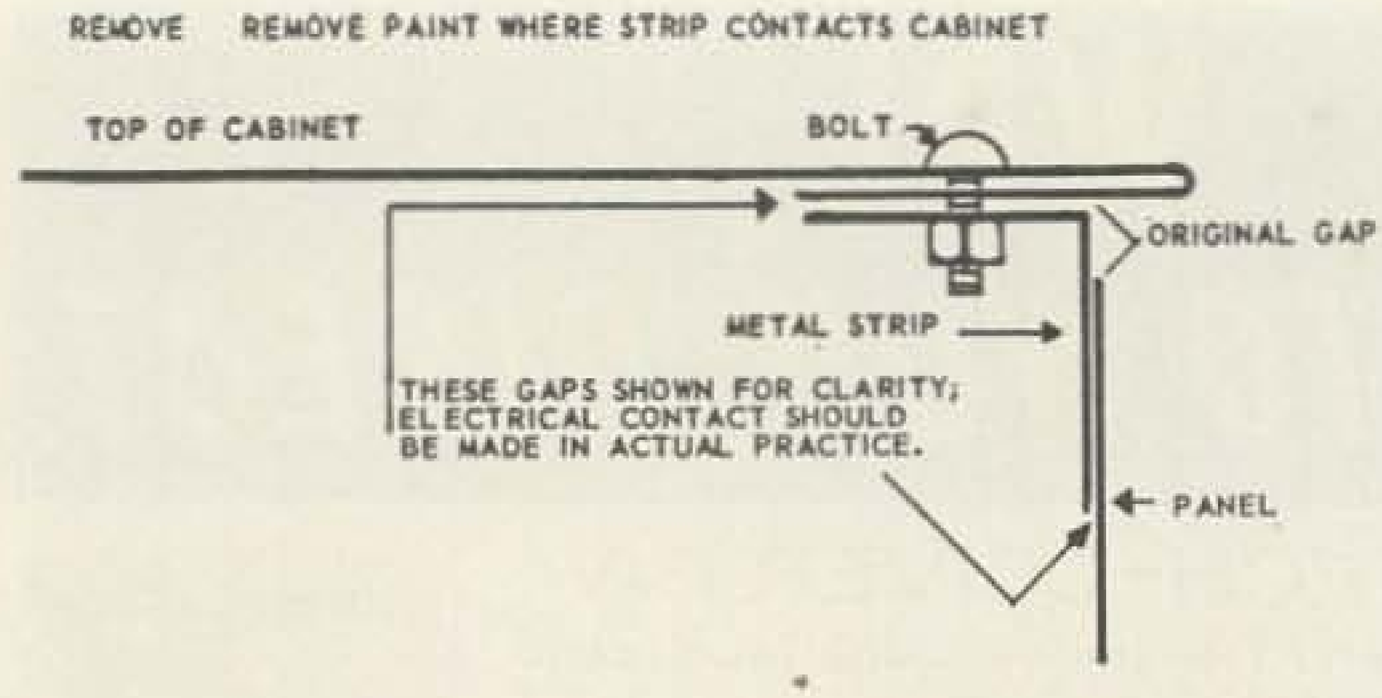
For phone work, audio voltage from a crystal or high-Z dynamic microphone is amplified by a 12AX7 and coupled to one grid of a

6DR7 twin triode modulator. A portion of the cathode voltage of the second half of the latter tube is applied to the 6146 screens to provide screen modulation with a type of carrier control. The operator at the other end of a QSO will report wide fluctuations in his S-meter reading, which is typical of controlled-carrier reception.

The power supply employs two solid state diodes in a voltage doubler, thereby saving both space and filament power, and eliminating a major source of heat.

Inspecting the 36 page assembly and operating manual, we find a page of illustrated soldering instructions and one of parts photographs; these are especially valuable in the sorting of the various types of machine screws, solder lugs, etc. There is also a page containing the resistor color code and photos of the common types of capacitors, and even a list of common CW abbreviations! Knight's usual enlarged assembly drawings are of course included. The schematic bound in the manual is 8½ x 11 and perfectly legible.

Evidence of the T-150's recent birth is provided by three supplementary sheets included with our manual. Two of these are devoted to minor circuit changes (2 resistors have been changed in value—the new components are



packed with the kit) and supplementary tune-up instructions, while the third contains additional comments on VFO alignment. To round out the manual we note three suggested methods of VFO calibration, operating instructions, a resistance-check chart, trouble-shooting hints, a circuit summary, and a parts list. However, we noticed that the tuneup instructions (which will be covered in detail later) did not mention explicitly the plate meter indications to look for when using the type of controlled-carrier/screen modulation employed in the T-150. Briefly, the story is this: while the final power input ratings are the same for both AM and CW, the AM rating refers to peak envelope power input[1], which is not followed by the plate meter. Call the plate current when tuned up for maximum CW output I milliamps. Then on AM, the no-signal plate current is about ½I, and the meter should kick up on voice peaks to around ⅔I. Any attempt to get more indicated power input by cranking up the gain control will only result in splatter as peak clipping sets in. Of course, an outboard clipper will help to raise the average modulation percentage.

In addition, we should mention for the record one typographical error in the manual: page 9, 12th construction step—"S-1A" should instead read "S-1B."

Actual construction time was 20½ hours, broken down roughly as follows: preliminary mechanical assembly—3 hrs.; wiring—16½ hrs.; final wiring check—1 hr. VFO calibration took less than one additional hour. No effort was made to rush construction. Most of the following notes on construction were made while assembling the kit.

The VFO tuned circuit components are mounted on a 2-piece subchassis for added rigidity and convenience in prewiring. The rotary switches used for band, xtal/VFO, and function switching are prewired before installation in the chassis. Perhaps this technique could be extended to some of the tube sockets, as there are a few tight spots in the layout. A pencil-type iron is indispensable here.

During the later stages of construction, L-shaped support brackets are temporarily screwed to the chassis to prevent damage to topside components when the transmitter is inverted for wiring. These are removed before installation in the cabinet.

There exists the possibility of momentary confusion when it comes to the identification of the multiplier tank coils, two kinds of coil identification being employed in our kit (although the manual indicates that one or the other will be used exclusively in the future). The surest way to avoid trouble here, and the best advice for any kit builder, is simply *read the entire manual and inspect the parts before starting construction.*

The only physical aspect of the transmitter in which I feel improvement could be made is the matter of rf shielding. The T-150, like its low-power predecessor the T-60[2], employs a one-piece wraparound cabinet fastened to the rear chassis apron with self-tapping screws; these provide the only positive contact between the chassis/panel assembly and the cabinet. In our kit, normal production tolerances permitted a gap to exist between the top of the recessed panel and the top of the cabinet when the transmitter was assembled. This provided a fine unwanted slot antenna. The most direct way to remedy this is to use a strip of electronic weatherstripping or aluminum angle stock placed so as to bear on the panel and cabinet after assembly, thus sealing the gap. See sketch. No TVI has been noticed with this seal.*

A welcome feature of the T-150 is the inclusion of provisions for an external plate modulator for those wishing to realize maximum output power. All necessary circuit connections are brought out to an octal socket at the rear of the chassis, and the manual includes details of the hookup required. (Remember to include the screen current if you use plate modulation). Similarly, an 11-pin socket provides switched 117 vac for an external antenna relay, a pair of terminals for externally controlled transmit/receive switching, and power connections. Voltages supplied to the pins are 700 vdc @ 50 ma, 300 vdc @ 50 ma, and 6.3 vac @ 0.5 a. This assortment is particularly attractive for the powering of a signal monitor of the Simplescope type[3]. In addition, an adaptation of Pafenberg's breakin and push-to-talk circuit[4] appears to be quite feasible.

The tuneup procedure is somewhat different from that usually employed with pi-net trans-

*Mfgr's. Note: K9PWT reviewed an early production of the T-150. Present units do have top of panel fastened to case, plus extensive added internal shielding. Present owners can obtain added shielding from Allied no charge.

mitters. The panel meter can be switched to read buffer grid current, final grid current, final plate current, and relative output. For relative output measurements, a sample of the rf output voltage is rectified and applied to the meter. After tuning the oscillator and buffer tank circuits to obtain maximum buffer and final grid currents respectively, the meter is switched to Relative Output. Now one of two procedures is followed, depending on whether operation will be on 6M or 10-80M. For 10 through 80, the Function switch is set to AM and the Final Tune and Load controls are simultaneously adjusted for maximum indicated output. The Function switch is then thrown to CW and the operation repeated. You are then ready to plug in your mike or key and get on the air.

On 6M, after tuning up in the AM position the capacitance of the Load capacitor is decreased enough to bring the key-down plate current to 250 ma. The Final Tune control is then adjusted for maximum indicated output.

Notice that the familiar "dip and load" procedure has been eliminated. Knight points out that maximum power output may possibly not occur at the plate current dip. The "Final Plate" position of the meter switch, besides being used in 6M tuneup, is employed in making sure that the plate current does not exceed 250 ma at maximum output. If it does, the buffer tank can be detuned slightly to bring it back down.

The entire tuneup procedure takes longer to describe than it does to perform. As I did not have an rf wattmeter available when testing the rig, the trusty light bulb dummy load was pressed into service to check the manufacturer's claims of output power. On 80-15M, the T-150 drove a 100 watt bulb to nearly full brilliance; on 10 and 6 it did a very creditable job with a 60 watt bulb. It appears that the Knight people know whereof they speak.

The rig is unusually handsome. The panel is two-tone gray with mirror-finish trim, while the cabinet is a medium gray hammer-tone. Meter and VFO calibrations are white on black, and the control knobs have aluminum disc inserts. A touch of color is provided by the red pin jacks used as a front panel crystal socket. The philosophy of the panel design seems to be to assign knob sizes in proportion to frequency of use during an operating session. A result is that the Function (i.e., transmit/standby) switch has a medium-sized knob which stands out from the five small knobs aligned with it along the bottom of the panel. This can be a great boon at the conclusion of a hard night's operating.

The T-150 has been in operation at K9PWT for only a short time. However, I can say that it has proven fully satisfactory for a controlled-carrier rig of the 150 watt class. I have not checked the VFO drift rate (Knight claims 200 cps in 20 minutes after a 10 minute warm-up), but I have held 45 minute QSOs without having to touch the knob to get back on frequency. As should be evident by this time, I think Allied Radio Corp. and the Knight-Kit division have come up with a fine low-cost transmitter in the T-150. . . . K9PWT

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[2]73 Tests the Knight T-60 Transmitter, W4WKM, March 1962, 73.

[3]The Simplescope, WϕOPA, p. 10, September 1961, 73.

[4]Break-in and Push-to-talk for the Knight T-60, W4WKM, p. 58, August 1962, 73.

CONDENSED SPECIFICATIONS

Frequency Coverage:	80-6 meters crystal or self-contained VFO.
DC Final Input:	150 watts on 80-10 meters; 100 watts on 6 meters, CW or controlled-carrier phone.
RF Output Power:	90 watts on 80-15 meters; 55 watts on 10 meters; 40 watts on 6 meters.
AC Power Required:	115 volts nominal; 180 watts on standby, 280 watts on AM, 350 watts on CW.
Output Circuit:	Pi network, matches 40-600 ohm load.
Size:	8½ x 17 x 10½ inches, height x width x depth; 28 lbs.

Scopes and Such

Staff

Undoubtedly, you've heard about using a scope to monitor modulation level. If you're an SSB addict, you might even have one in your shack. But do you know just how much you can actually see with a simple scope?

For instance, did you ever check your carrier for harmonics, using the scope? Or measure the *other fellow's* modulation (a good way to lose contacts rapidly, we might add, if you give honest reports)?

Other uses include determination of proper operating bias (even for AM transmitters), tracking down of parasitics, neutralization of the transmitter, and determining the proper impedance match between the modulator and the final. Except for the technique of measuring modulation percentage at the receiver, all of these things can be accomplished easily with a completely basic scope; by swiping high voltage from the transmitter power supply, you can build a perfectly adequate instrument for almost pennies (later on, we'll tell you how).

For a start, though, let's examine these various uses of the scope.

In checking out transmitters, you have a choice of three basic types of screen pattern. They are the trapezoid (most popularized), the wave-envelope, and the block.

The trapezoid, obtained by applying modulated rf from the rig's output to one pair of the scope's plates and audio from the modulator to the other pair, is basically a picture of the relationship between instantaneous af voltage and the corresponding rf output voltage. A typical pattern showing 100 percent modulation with no transmitter troubles appears in Fig. 1.

The wave-envelope, obtained by applying modulated rf from the rig to one pair of plates as before but feeding a regularly recurring sweep voltage (such as 60-cycle ac from the power lines) to the other pair, is more a picture of individual audio cycles as they are transmitted. Fig. 2 is a typical pattern showing clean, 100 percent modulation.

The block, not so well known as the other two patterns, is obtained by applying rf output (either modulated or unmodulated) from the rig to one pair of plates. The other pair is fed a recurrent sweep voltage, which again may be 60-cycle ac from the power line. The difference between the wave-envelope display and the block display of a modulated wave is that the modulating frequency should not be greater than four to five times the sweep frequency for a wave-envelope, but should be at least 10 to 12 times sweep frequency for a block.

The trapezoid and wave-envelope patterns are useful primarily for checking modulation percentage, operating bias values, locating parasitics, and determining proper modulator-to-final impedance matching.

The block pattern, though it may be used to