"Tom Thumb"

A Combination Single-Tube Transmitter-Receiver Complete with Power Supply

BY PAUL J. PALMER,* W8UGR

"Hi, dere, fellers," said Tuffy 6L6G. "At last dis guy 8UGR gimme a rest wid dis conbinashun oscilliater 'n' reception committee. Boy, shur'sa relief from wot Fred Sutter 'n' sum o' youse guys had me doin'. Dat 8QBW sure boined me up more'n once wid his gestoppo tackicks. Dese lil 79s er 6Y7Gs 'r' sure swell pals — 'n' cheap too. Dey kin woik bote en's agin de mittle widout lettin' ya down. Youse kin use dis lil peewee fer dat State Guard 5-watt eighty meter ban, too, widout no trouble as well as bein' swell fer de emoigency woik when we gits bak on. Well, gang, 'slong 'n' 73. BCNU, I hope."

"Tom Thumb" is a small, compact, complete little c.w. rig just a mite bigger than the QSL-type rigs. Both transmitter and receiver are mounted on a single chassis, primarily designed for QRP work and AEC emergency service.

The rig is designed primarily for the 40- and 80-meter bands, and while not of high power — around 6 or 7 watts output — it can serve very readily in local emergency service. In fact, it would be very suitable for the recently authorized 3.5-Mc. band State Guard WERS service.

The Circuit

The circuit for "Tom Thumb," shown in Fig. 1, really comprises two separate units. The 79 (or its octal-base counterpart, the 6Y7G) is a twin triode with the grid of one section connected to a cap at the top of the tube. This latter section is used as a detector in a single-tube regenerative circuit, while the other triode section is used as a simple tetrode crystal oscillator.

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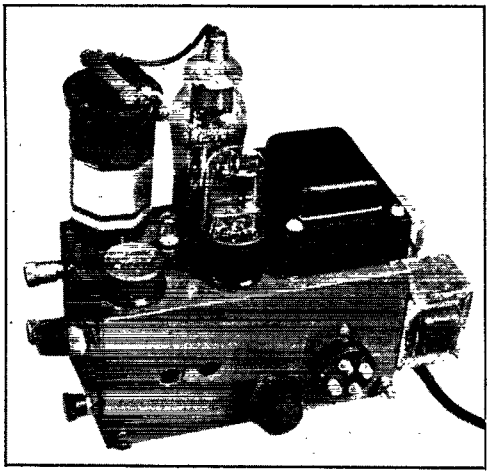


Top view of the "Tom Thumb" transmitter-receiver. The 79 tube is in the rear and the 6X6GT in front. Along the front edge are the screwdriver-tuning openings, the regeneration control knob, and the audio-output socket for making connections to an external audio amplifier.

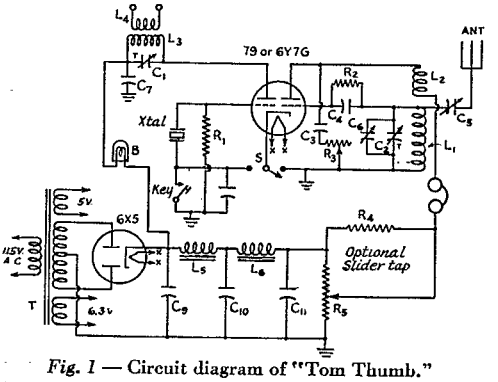


Fig. 1 — Circuit diagram of "Tom Thumb."

C_1, C_2 — 140-$\mu\mu$fd. dual ceramic trimmer.
C_3, C_4, C_7 — 100-$\mu\mu$fd. mica.
C_5 — 3-30-$\mu\mu$fd. trimmer.
C_6 — 100-$\mu\mu$fd. midget variable.
C_8 — 0.01-μfd. tubular, 300 volts.
C_9, C_{10}, C_{11} — 8-μfd. 400-volt electrolytic.
R_1 — 50,000 ohms, 1 watt.
R_2 — 2.5 megohms, ½ watt.
R_3 — 6,000 ohms, wire-wound.
R_4 — 25,000 ohms, 2 watts. (May be replaced by slider on R_5.)
R_5 — 25,000 ohms, wire-wound. (Slider optional.)
L_1, L_2, L_3, L_4 — See coil chart.
L_5, L_6 — 15-h. filter choke.
B — 60-ma. pink-bead dial lamp.
S — S.p.d.t. switch.
T — 450 volts, c.t., 40 ma.; 6.3-volt filament.

Several novel features are provided, being the use of a dual ceramic band-set condenser to tune the tank circuit of the transmitter and the tuning circuit of the receiver. This makes it possible to set the transmitter tuning at the best possible position for the crystal; once adjusted, it is not likely to be jarred off tune by handling. It is possible also to tune very close to the desired frequency for the receiver and then simply use the band-spread condenser for slight variations caused by the antenna or other detuning effects. The dual ceramic condenser has a capacity of 140 $\mu\mu$fd. per section. It is adjusted through small holes in the chassis. This system was adopted to eliminate as many controls as possible, after the style of police and other equipment designed for emergency use.

In lieu of the dual ceramic condenser, small air trimmers could be mounted in the coil forms for band-setting controls. This would simplify considerably the wiring of the coil sockets, and give more flexible control for quick crystal change-over.

Since, in the sort of service in which the rig is designed, long-range reception is not needed, the single-tube regenerative receiver is all that is required. If greater output is wanted for loudspeaker operation, a simple single-tube amplifier, such as the circuit in Fig. 2, should prove adequate. This stage could be built into a small speaker case with filament and plate power supplied from the main rig.

Regeneration for the receiver is controlled by means of the shunt variable-resistor and fixed-condenser method which is very quiet in operation and has a minimum detuning effect.

The grid-leak resistor and condenser for the receiver grid circuit are mounted on the top of the coil with the antenna lead attached through a small 3-30-$\mu\mu$fd. mica trimmer condenser for proper adjustment and elimination of "dead" spots in the tuning range. The transmitting coil also has its antenna connections at the top of the form, thereby avoiding the necessity for feed-through insulators in the chassis.

Because the 79 or 6Y7G tube has a single cathode terminal, a change-over switch is necessary to provide proper operation of either the transmitting or receiving portion of the rig. In the event that 6F8G or 6C8G tubes are used, only a single-pole single-throw switch is necessary instead of the double-throw single-pole type, since in the latter case only a stand-by switch is needed to cut off the plate supply from the receiver when transmitting.

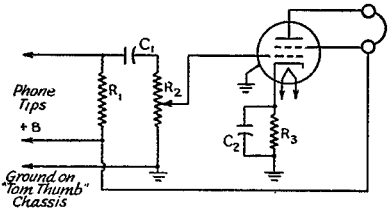
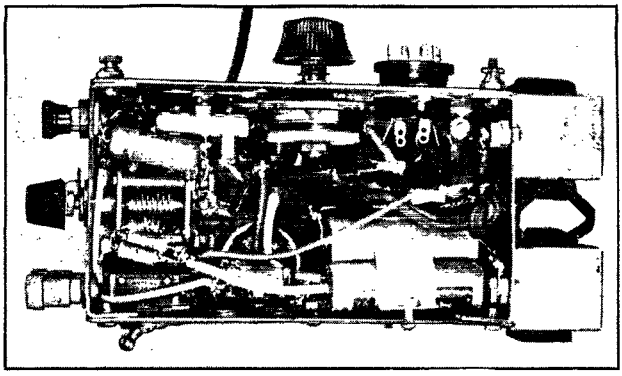


Fig. 2 — Circuit diagram of an audio amplifier for the "Tom Thumb" receiver.
C_1 — 0.01-μfd. paper.
C_2 — 10-μfd. 50-volt electrolytic.
R_1 — 0.25 megohm.
R_2 — 0.5-megohm potentiometer.
R_3 — 400 ohms.

Power Supply

The power supply is of the condenser-input type, with two chokes and three filter condensers to provide sufficient filtering to insure hum-free receiver operation. With the power transformer specified, around 8 watts input power can be had; if the slightly larger Thordarson T-13R11 transformer is used, about twenty-five per cent more input power can be obtained. This latter transformer would take up no more chassis room.



Bottom view of the "Tom Thumb" transmitter-receiver. The filter chokes are fastened outside the right-hand end of the chassis, the filter condensers being mounted inside. The bandspread tuning condenser for the receiver may be seen to the left.

The 6X5 rectifier was selected because of its small size, but an 80 could be used since a 5-volt filament winding is available.

Power for the transmitter is taken off after the first filter condenser, to obtain as high voltage and therefore power input as possible. The writer has found that in c.w. operation such simple filters are ample for a clear signal. This connection also eliminates voltage drop through the filter chokes.

Construction

The chassis is of the QSL type but it is one-half inch longer in order to accommodate the power transformer, the two tubes and the two coil sockets. It is a simple affair bent-up from sheet aluminum in a manner similar to that used in the other recent rigs described by the writer. The template sketch given in Fig. 3 shows the disposition of the various units.

The crystal socket may be of the 5-prong wafer type, mounted on the inside of the left panel with holes drilled ¾-inch apart and of sufficient diameter to clear the crystal plug-in pins. The ceramic condenser is mounted on the right side with a small spacer to insure ample clearance from the

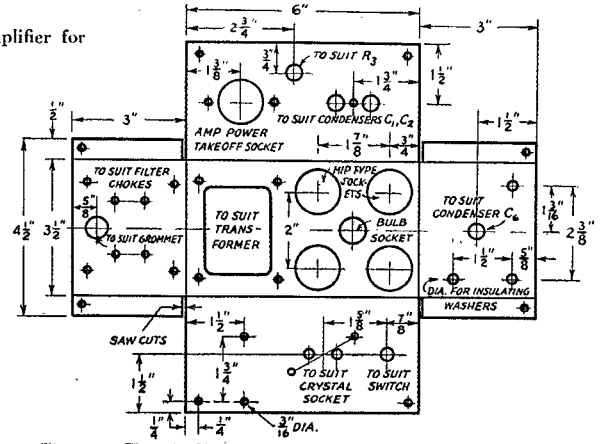


Fig. 3 — **Chassis dimensions for the "Tom Thumb" transmitter-receiver showing the location of the various components.**

panel. Holes are drilled in proper position for screwdriver adjustment.

The lay-out is such that the right end is really the front of the rig, with the stand-by switch at the left, the regeneration control at the right, and the headphone and key terminals at the left and right of this "front" face, respectively. The receiver bandspread-condenser control also is on this edge. The tubes are mounted nearest the transformer, with the coil sockets at the opposite end from the power transformer.

In the event an amplifier is wanted, the power take-off socket can be mounted as indicated, with suitable connections. A small light could also be furnished for night operation in the field. All other component placing is clearly indicated, and no difficulty should be had in building up "Tom Thumb."

Adjustment

In first adjusting this little outfit, the regeneration control should be manipulated so that the regeneration noise is just starting, since this point is the most sensitive one for c.w. reception. The tuning condenser then is set with the screwdriver adjustment until the desired frequency is found, then the bandspread condenser is adjusted to give the best pitch for clearest copy.

The bleeder-resistor tap should be adjusted so as to give smoothest control of regeneration. Different tubes may require a change in this setting. Experimentation for the proper value of resistor, R_4, for most efficient detector operation may be needed.

In adjusting the transmitter, the plate current at resonance should light the 60-ma. bulb to around medium brightness, since the 79 or 67YG tube draws around 35 ma. However, for short periods and intermittent operation, a higher plate current may be drawn from the transformer without danger of overheating. As previously mentioned, the plate-voltage tap for the transmitter is taken off at the first input condenser of the filter circuit. In the event of a rough signal, this tap may be moved to the second condenser which would then give better filtering, but with a slight reduction in voltage.

It is the hope of the writer that this little outfit will prove to be a useful type for AEC work, since large numbers could be built and tuned to a given net frequency.

COIL TABLE

	Band	L_1	L_2	
Receiver:	1750 kc.	70 turns	20 turns	No. 30 d.s.c. wire on 1½-inch form close-wound
	3500 kc.	35 "	10 "	
	7000 kc.	15 "	6 "	
	14000 kc.	5 "	4 "	
		L_3		
Transmitter:	1750 kc.	49 turns	No. 22 s.c.c.	Spaced to give coil length of 1½ inches
	3500 kc.	28 "	No. 22 s.s.c.	
	7000 kc.	18 "	No. 18 enam.	
	14000 kc.	10 "	No. 18 enam.	

L_4 Number of turns to be determined experimentally to give proper plate current readings when tuning at crystal frequency.

★ SPLATTER ★

OUR COVER

DESPITE a probable first-glance impression of tropical pleasure cruising atmosphere on this month's cover, there is both a radio angle and a serious purpose involved. This is a picture of the radio ship *Apache.* Of particular interest are S/Sgt. Melvin W. Gade adjusting the v.h.f. antenna and the GI helmet used as an improvised corona ring for the medium-frequency broadcast antenna. *Official U. S. Army Signal Corps photo.*

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FOOTNOTES

THE tale of how the veteran *Apache* was converted into a radio ship and the part it played during Allied landings in the Pacific zone is told (p. 39) by **Lt. Anthony W. Borgia, W6EOU.** Lt. Borgia served aboard the *Apache* as transmitter officer during both the Leyte and Luzon invasions. His yarn was written in the Philippines but he returned to the U. S. A. on a 30-day leave just in time to supply the qualifying quota of autobiographical data. In his own words: "I was first licensed in 1928 with the call W6EOU. I was very active on 7-Mc. c.w. handling traffic during the years 1929 to 1933. From 1937 to 1941 did extensive 'phone operation on the 3.5- and 14-Mc. 'phone bands. Made WAC on both 'phone and c.w. Became a member of the Royal Order of the Wouff Hong several years ago. Was one of the first West Coast c.w. amateurs to make contact with WFA — the first Byrd Antarctic Expedition at Little America — using 35 watts input to a pair of '10s in a self-excited rig. Hold first-class radiotelephone and second-class radiotelegraph licenses. Inducted into the infantry in 1941; later transferred to the Signal Corps. Served as enlisted radio operator on an Army transport for about a year. Was sent to Australia in 1943 and saw duty in New Guinea and the Philippines. Received my commission in November of '42 at Fort Monmouth, and by now have served approximately 33 months overseas." . . . **Albert Kahn, W9KYM,** not only is an authority on microphones — he's the founder and for the past fifteen years has been president of Electro-Voice — but is well able to explain in ham language how they work (p. 34). An old-timer in ham radio and a qualified member of the 20-Year Club, Al Kahn used to be steadily active on the air, and will be again when the gong sounds. A c.w. man at heart, he has been ORS through the years and — amazingly enough — only occasionally on 'phone. The answer? Ham radio is a hobby; microphones are a business. The former dates back some 23 years (Al was first licensed in 1922 as 9BBI), but microphones a mere 17. Al, like a lot of others, started with a Ford spark coil, ½-kw. spark, 1-kw. spark, "five-watter," "fifty-watter," et cetera. He has enjoyed all phases of ham activity — traffic, rag-chewing, DX, mobile, an-

(Continued on page 98)