Push-Pull 6146s in a Two-Stage Rig

Five Bands with No Switching

BY ARMAND RENAUD,* VE2RZ

• This simple two-stage transmitter makes use of multiband tuners to cover the 80- to 10-meter range. The push-pull 6146 final amplifier will take up to 180 watts on c.w. A clamp-tube modulator, power supply, and provision for VFO input are included.

THE rig shown in the photographs has worked out so well that perhaps others will be interested in the details. The circuit is shown in Fig. 1. A 5763 crystal oscillator drives a pair of 6146s in push-pull. Multiband tuners in both stages make switching unnecessary in covering all bands, 80 through 10 meters inclusive. Crystals in the 14-Mc. range are required for 28-Mc. output.

The oscillator is keyed for c.w., and the amplifier is protected by a 6216 screen clamper and series VR tube. The 6216 also serves as a screen modulator for phone operation.

In the amplifier stage, C_2 is a small trimmer capacitor whose purpose is to balance the grid drive by compensating for the output capacitance of the 5763, which appears across the opposite side of the push-pull circuit. L_1, L_2 and the 100-

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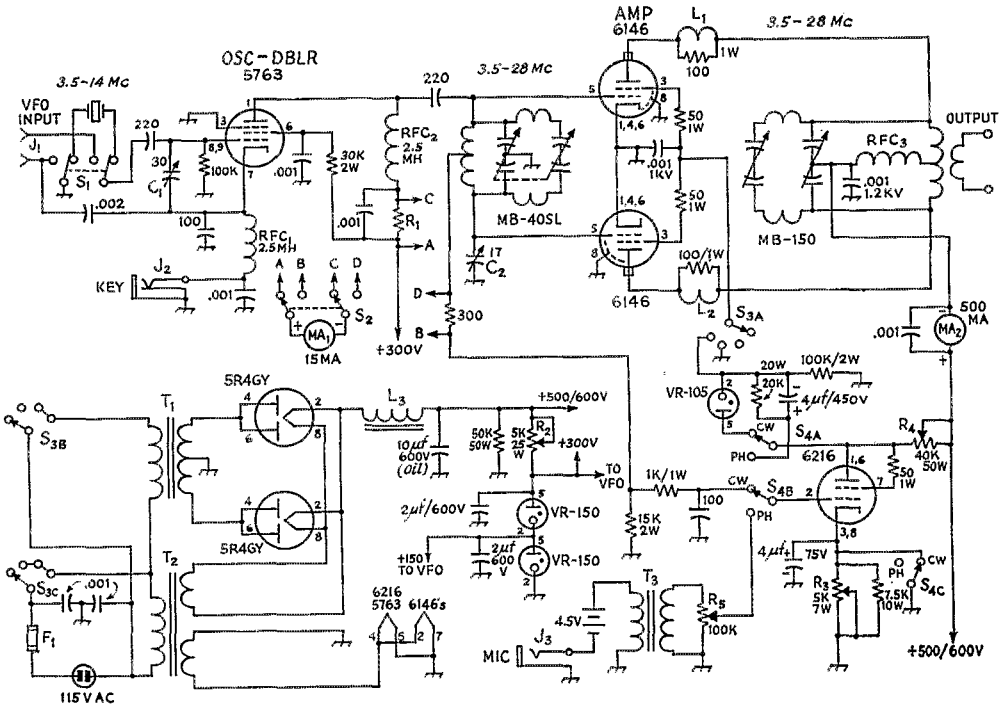
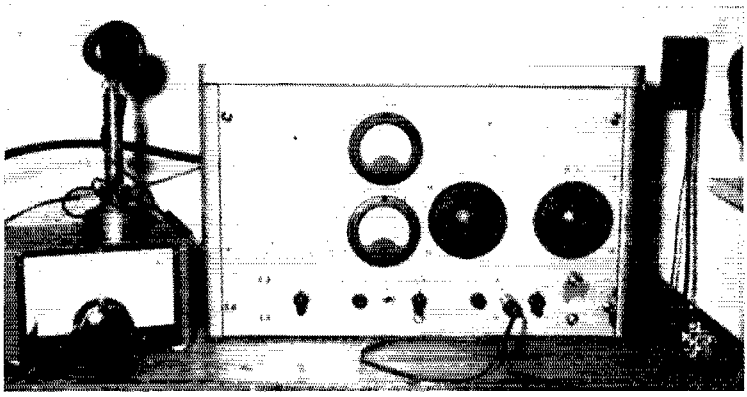


Fig. 1 — Circuit of VE2RZ's transmitter. All capacitances less than 0.001 μf. are in μμf. Unless otherwise designated, all 0.001-μf. capacitors are disk ceramic, and polarized capacitors are electrolytic. Other fixed capacitors (except filter capacitors), may be mica or ceramic. All resistors are ½ watt unless otherwise specified. The multiband tuners are produced by the National Company.

C_1, C_2 — Ceramic compression-type trimmer.
R_1 — Wire-wound shunt adjusted to give MA_1 a full-scale deflection at 100 ma. See text.
R_2, R_4 — Adjustable slider tap.
R_3 — Wire-wound pot. (Mallory E5MP or similar).
L_1, L_2 — No. 12 enam. wire close-wound full length of 1-inch 100-ohm 1-watt resistor.
L_3 — 10 h., 400 ma. or more (Triad C-22A or similar).
F_1 — 10-amp. fuse.
J_1 — Prongs on octal socket also used as crystal socket.
J_2 — Closed-circuit jack.
J_3 — Open-circuit jack.
MA_1, MA_2 — 2¾-inch milliammeter.
S_1 — D.p.d.t. toggle switch.
S_2 — D.p.d.t. spring-return switch.
S_3 — Three-wafer 4-position bakelite rotary.
S_4 — Three-pole d.t. rotary.
T_1 — Plate transformer: 1200 to 1400 volts r.m.s., c.t., 400 ma. (Triad P-9A, Thordarson 21P85).
T_2 — Combination filament transformer: 5 volts, 4 amp. or more; 6.3 volts, 5 amp. or more (Thordarson 21F23, Triad F-38A). Individual transformers may be substituted.
T_3 — Single-button carbon microphone to grid.



Along the bottom of the panel, from left to right, are S_3, R_3, J_3, S_2, R_5, J_2 and S_4. The cabinet is a standard type for 12¼-inch rack panels. The unit to the left is the remote tuner for the VFO.

ohm resistors in the 6146 plate leads combine with the 50-ohm resistors at the screen terminals to suppress v.h.f. parasitics.

The milliammeter MA_1 may be switched to read either oscillator plate current or amplifier grid current. A wire-wound shunt, R_1, is adjusted to increase the full-scale reading to 100 ma. when checking oscillator plate current. (See measurements chapter of the ARRL *Handbook*.) A second milliammeter, MA_2, is connected permanently in the plate circuit of the amplifier.

A power supply delivering approximately 500 volts at 400 ma. is included in the unit. The rectifiers are 5R4GYs with elements paralleled to handle the full load current. A regulated 300-volt tap for the oscillator is provided by a pair of VR150s.

S_3 is a control switch. In the first position, all power is off. In the second position, S_{3C} turns transmitter and rectifier filaments on. In the third position, S_{3B} turns the high voltage on, while S_{3A} grounds the screens of the 6146s so that these tubes draw negligible plate current while the 5763 is tuned up. In the last position, S_{3A} applies screen voltage to the 6146s.

S_4 is the phone-c.w. switch. In the c.w. position (shown in Fig. 1), S_{4B} connects the grid of the 6216 clamper tube to the amplifier grid leak, S_{4A} supplies screen voltage to the 6146s through a VR tube which acts as an electronic switch to cut off screen voltage when the key is open, and S_{4C} shorts the 6216 cathode resistor. In the phone position, the microphone transformer is connected to the grid of the 6216 by S_{4B}, reduced screen voltage is applied to the 6146s through S_{4A}, and cathode bias is applied to the 6216 as S_{4C} removes the short across the cathode resistor.

Provision is included (S_1) for switching the input of the 5763 to the output of a remotely-tuned VFO similar to the one described in the last three editions of the ARRL *Handbook*, and in *QST* for January, 1953. The 5763 then functions as an amplifier or frequency multiplier. Plate and screen voltages for the VFO are taken from the 300- and 150-volt regulated taps of the transmitter power supply as indicated in Fig. 1.

Construction

The unit is constructed on a 17 × 10 × 3-inch chassis fitted with a 12¼-inch rack panel. The right-hand half of the chassis (as viewed from the rear) is devoted to the power supply. The two multiband tuners, enclosed in shielding compartments of aluminum sheet, occupy the remainder. The two 6146s are in the compartment with the MB-150, while the 5763 is to the rear of the MB-40SL. The cover of the amplifier compartment is drilled for ventilation. An octal socket and the crystal-VFO switch are to the rear of the oscillator enclosure. The octal socket is wired up as a combination crystal socket and VFO input connector.

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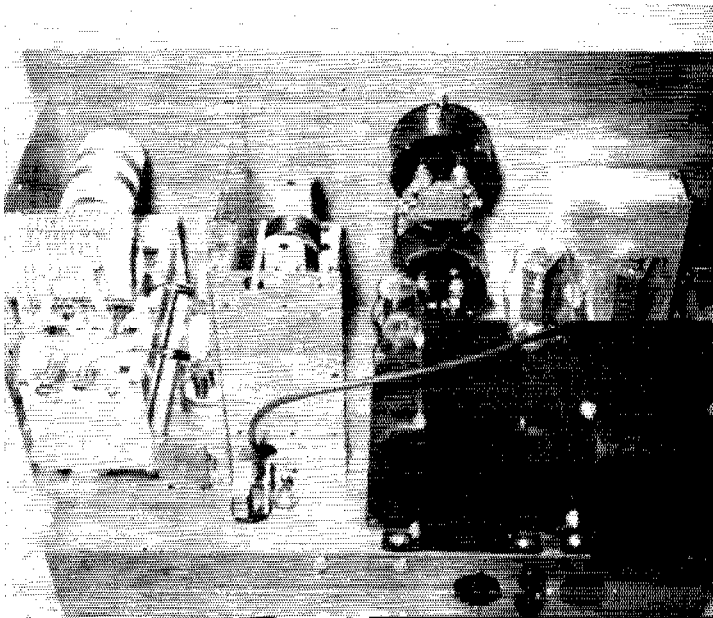

Portions of the shielding enclosures for the multiband tuners have been removed in this rear view of VE2RZ's push-pull 6146 transmitter. The octal socket used as a crystal socket and also as input connector for the VFO is to the rear of the crystal-oscillator compartment. The toggle switch is S_1. The 2 × 4 × 4-inch aluminum box near the right-hand end of the panel houses the tube and associated components of a remotely-tuned VFO. The filament transformer, T_2, is under the chassis.

Push-Pull 6146's

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Along the bottom of the panel, from left to right, are the power-control switch (S_3), the clamper-tube biasing resistor (R_3), the microphone jack (J_3), the meter switch (S_2), the audio gain control (R_5), the key jack (J_2), and the phone-c.w. switch (S_4). A.c. connectors and a fuse are at the rear.

The filament transformer, T_2, is mounted underneath the chassis. This combination 5- and 6.3-volt transformer may, of course, be replaced by two separate units.

If TVI is a consideration, all power wiring should be done with shielded wire, and the bypasses applied as described in the TVI chapter of the ARRL *Handbook*.

A low-pass filter using capacitors with type CM-45 cases, and patterned after one described in the *Handbook*, is attached to the rear of the cabinet in which the transmitter is housed.

Adjustment

With S_3 turned to the third position (6146 screens grounded), and the key closed, the slider on R_2 should be adjusted so that the VR tubes stay ignited. (CAUTION: *Be sure to turn off high voltage when adjusting the slider!)*

Output on 80 or 40 meters may be obtained with 3.5-Mc. crystals, and output on 40, 20 or 15 may be obtained with 7-Mc. crystals. Output on 10 meters requires 14-Mc. crystals. Output on 15 meters may also be obtained using 10.5-Mc. crystals. The chart furnished with the multiband tuners will show the approximate settings for each band, and resonance will be indicated by a dip in plate current. Each resonance should be checked initially with a wavemeter or g.d.o. to make sure that it is at the desired frequency. The dip in oscillator plate current should be accompanied by a rise in amplifier grid current. C_1 should be adjusted for optimum oscillator output as indicated by amplifier grid current. A grid-current reading of 4 to 6 ma. should indicate adequate excitation. After maximum grid current has been obtained on one of the higher-frequency bands, the 6146 whose grid is connected to C_2 should be removed from its socket, and the grid current to the remaining tube should be noted. Then, the first tube should be replaced, the second tube removed, and C_2 adjusted until the grid current is as close as possible to the value noted with the other tube.

With a load coupled to the amplifier, plate voltage may be applied, and the MB-150 tuned for resonance as indicated by the amplifier plate-current dip. Resonances should be checked with a wavemeter as before. The slider on R_4 should be adjusted to give a screen voltage of 150 to 160 with the amplifier loaded to rated input. (CAUTION: *Be sure to turn off high voltage before each adjustment of the slider!*) Plate current on c.w. should be limited to 300 ma. by adjustment of loading.

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With S_4 in the phone position, R_3 should be adjusted until the plate current is reduced to half the value normally used for c.w. operation. Then the audio gain control should be advanced until the plate current shows a small upward flicker on voice peaks.

With the VFO mentioned previously driving the 5763, adequate excitation to the final has been obtained on all bands up to and including 14 Mc., quadrupling in the 5763 for the latter.

Directional Antenna

(*Continued from page 31*)

may be mounted on the car is important. We have had cases where a transmitter hunter has driven around town and all his bearings pointed at the broadcast antenna on the car. This is not conducive to great success as a transmitter hunter.

Secondly, the site from which a bearing is taken should be chosen carefully. Ideally, an area clear of all obstructions for perhaps 100 yards in all directions should be chosen. Sites of this type are usually quite rare, especially in an urban area. Since the ideal site is usually not available, the actual site chosen should be picked so that it conforms as nearly as possible to the ideal case. This means staying as far as is practicable from buildings, telephone poles, trees, woods, antennas and any other obstructions of this type.

An S meter is also a handy adjunct to the mobile direction finding installation. A simple and effective S meter is a 20,000-ohms-per-volt multimeter used to measure the a.v.c. voltage developed by the mobile receiver. Another convenience is some method of being able to apply either the output of the loop or the signal from the mobile whip antenna to the mobile receiver. A coaxial relay is especially convenient for this purpose.

An acknowledgment is made to W8BUQ, John Braschwitz, and W8GHO, Bob Koren, for helpful advice and assistance in designing, constructing and using the loop antenna described in this article.

S.E.T.

(*Continued from page 42*)

Porter Co., Ind.	W9HDB[2]	195
Princeton, W. Va.	W8DFC[3]	—
Pulaski Co. & Fort Leonard Wood, Mo.	WØVPQ	58
Putnam Co., N. Y.	W2HIQ[2]	85
Putnam Co., Tenn.	W4PVD[3]	—
Queens Co., N. Y. (10 Meters)[1]	W2IAG	234
Racine, Wis.[6]	W9SZL	104
Ramsey Co., Minn.[1]	WØHKF	245
Redding, Conn.	W1ODW[2]	62
Redwood City, Menlo Park, San Carlos, Calif.[8]	W6EXX	197
Richmond Boro (Staten Island), N. Y.	W2VKF[2]	211
Rock Island & Mercer Cos., Ill.[8]	W9RYU[2]	97
Rockingham Co., N. H.	W1CDX	45
Rockland Co., N. Y.	W2ZTZ	150
San Luis Valley, Colo.[1]	WØKQD	92

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