A 75-WATT 6DQ5 TRANSMITTER

The transmitter shown in Fig. 6-43 is designed to satisfy the requirements of either a Novice or General Class licensee. As described here it is capable of running the full 75 watts limit in the 80-, 40- and 15-meter Novice bands, with band switching, crystal switching and other operating features. The General license holder can use the transmitter in any band 80 through 10 meters, and he can add v.f.o. control or amplitude modulation at any time without modifying the 6DQ5 transmitter. Crystal switching is a convenience for rapidly shifting frequency within a band to dodge QRM, and a SPOT position on the operate switch permits identifying one's frequency relative to others in a band. An accessory socket, X_3, furnishes a convenient point for borrowing power for a v.f.o. or for controlling the oscillator by an external switch.

Referring to Fig. 6-44, the circuit diagram of the transmitter, the crystal selector switch, S_1, is used to choose the desired crystal. For crystal-controlled operation crystals would be plugged in pins 1 and 3 and 5 and 7 of socket X_1. Similar sockets (not shown in the diagram) are used to hold the other crystals. When v.f.o. operation is desired, the v.f.o. output is connected to J_1, the plug P_1 is inserted in socket X_1 and the former 6AG7 crystal oscillator stage becomes an amplifier or multiplier stage when switch S_1 is turned to position 1.

Since the output of the 6AG7 stage will vary considerably with the bands in use, an excitation control, R_1, is included to allow for proper adjustment of the drive to the 6DQ5 amplifier. The 6DQ5, a highly sensitive tube, is neutralized to avoid oscillation; the small variable capacitor C_2 and the 390-$\mu\mu$f. mica capacitor form the neutralizing circuit. Screen or screen and plate modulation power can be introduced at socket X_2; for radiotelegraph operation these connections are completed by P_2. Grid or plate current of the 6DQ5 can be read by proper positioning of S_5; the 0–15 milliammeter reads 0–15 ma. in the grid-current position and 0–300 ma. in the plate-current position.

The transmitter is keyed at J_3, and a key-click filter (100-ohm resistor and C_5) is included to give substantially click-free keying. The v.f.o. jack, J_4, allows a v.f.o. to be keyed along with the transmitter for full break-in operation.

Construction

A 10 × 17 × 3-inch aluminum chassis is used as the base of the transmitter, with a standard 8¾-inch aluminum relay rack panel held in place by the bushings of the pilot light, excitation control and other components common to the chassis and panel. The panel was cut down to 17 inches in length so that the unit would take a minimum of room on the operating table. A good idea of the relative location of the parts can be obtained from the photographs. The support for the r.f. portion housing is made by fastening strips of 1-inch aluminum angle stock (Reynolds aluminum, available in many hardware stores) to the panel and to a sheet of aluminum 9½ inches long that is held to the rear chassis apron by screws and the key jack, J_3. A piece of aluminum angle must also be cut to mount on the chassis and hold the cane-metal (Reynolds aluminum) housing. Fig. 6-46 shows the three clearance holes for the screws that hold this latter angle to the chassis after the cane metal is in place. Build the cane-metal housing as though the holes weren't there and the box has to hold water; this will minimize electrical leakage and the chances for TVI. To insure good electrical contact between panel and angle stock, remove the paint where necessary by heavy applications of varnish remover, with the rest of the panel masked off. The paint will blister and be easy to remove; wash the panel and then drill the holes for the components and screws. (If the holes are drilled first, the remover may leak

Fig. 6-43—This 75-watt crystal-controlled transmitter has provision for the addition of v.f.o. control. A 6AG7 oscillator drives a 6DQ5 amplifier on 80 through 15 meters.

As a precaution against electrical shock, the meter switch, to the immediate right of the meter, is protected by a cane-metal housing. The switch to the right of the meter switch handles the spot-operate function, and the switch at the far top right is the plate-circuit band switch.

Along the bottom, from left to right: pilot light, excitation control, crystal switch, grid-circuit band-switch, and grid-circuit tuning.

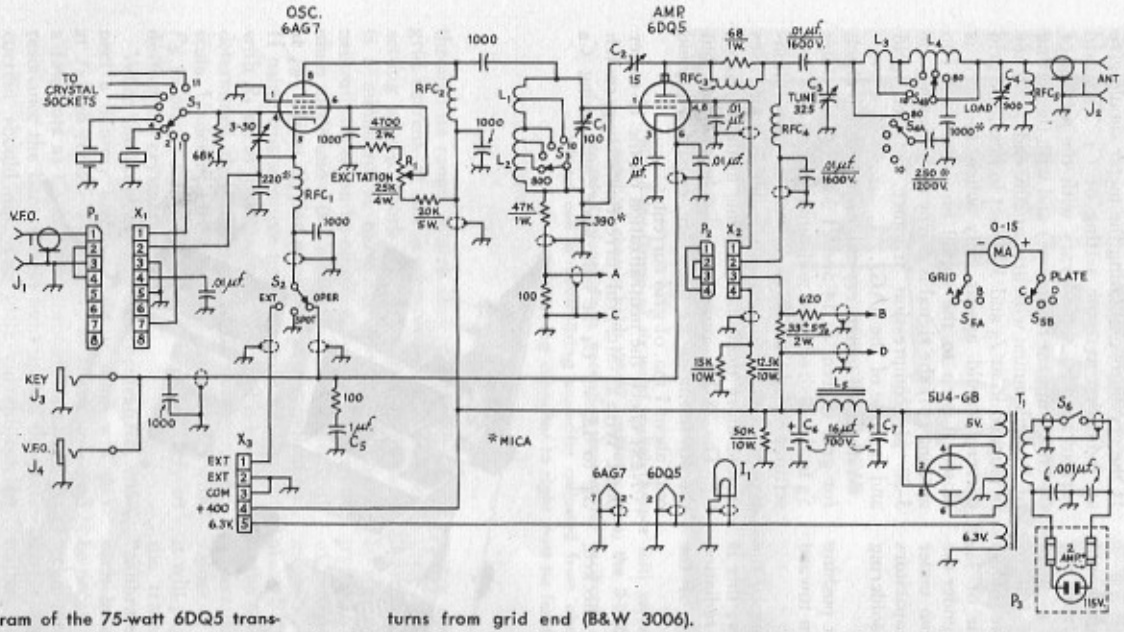

Fig. 6-44—Circuit diagram of the 75-watt 6DQ5 transmitter. Unless specified otherwise, capacitance is in picofarads (pf. or μμf.), resistance is in ohms, resistors are ½ watt.

C_1—100-pf. midget variable (Hammarlund HF-100).

C_2—15-pf. midget, .025 inch spacing (Johnson 15J12).

C_3—325-pf. variable (Hammarlund MC-325-M).

C_4—Dual 450-pf. broadcast replacement variable, two sections connected in parallel. (Allied Radio 61H059).

C_5—1-μf. 400-volt tubular.

C_6, C_7—16-μf. 700-volt electrolytic (Aerovox PRS).

I_1—6-volt pilot lamp.

J_1—Phono jack.

J_2—Coaxial connector, chassis mounting, type SO-239.

J_3, J_4—Open-circuit phone jack.

L_1—7½ t. No. 18, ⅝-inch diam., 8 t.p.i., tapped 5½ turns from grid end (B&W 3006).

L_2—38 t. No. 32, 1 inch diam., 32 t.p.i., tapped 23 and 31 turns up (B&W 3016).

L_3—5 turns No. 14, 1-inch diam., 4 t.p.i., self-supporting, tapped 3½ turns from plate end.

L_4—15 turns No. 14, 1¾ inch diam., 4 t.p.i., tapped 6¼ and 10¼ from output end (B&W 3021).

L_5—10-henry 200-ma. filter choke (Triad C-16A).

P_1—Octal plug (Amphenol 86-PM8).

P_2—4-pin plug (Amphenol 86-PM4).

P_3—Fused line plug.

R_1—25,000-ohm 4-watt (Mallory M25MPK).

RFC_1, RFC_2—750-μh. 100-ma. r.f. choke (National R-33).

RFC_3—3 turns No. 14 around 68-ohm 1-watt composition resistor.

RFC_4—1-mh. r.f. choke, 500 ma. (Johnson 102-752).

RFC_5—2.5-mh. r.f. choke (National R-100S).

S_1—1-pole 11-position rotary ceramic switch Centralab Y section on P-121 index assembly).

S_2—Single-pole 11-position (3 used) non-shorting rotary switch (Centralab PA-1001).

S_3—Single-pole 12-position (5 used) rotary ceramic switch (Centralab PA-1 on PA-301 index assembly).

S_4—2-pole 5-position rotary ceramic switch (Centralab 2505).

S_5—2-pole 6-position (3 used) non-shorting ceramic rotary switch (Centralab PA-2003).

S_6—S.p.s.t. toggle.

T_1—800 v.c.t. 200-ma. transformer (Triad R-121-A).

X_1—Octal tube socket.

X_2—4-pin tube socket.

X_3—5-pin tube socket.

through and spoil the paint on the front of the panel.)

From a suitable piece of cane metal, make the four-sided 2¼ × 2¼ × 2¼-inch box that covers S_5, and fasten it to the utility-box cover with sheet-metal screws. Don't forget J_1 on the side of the box.

The self-supporting coil, L_3, can be wound on the envelope of the 6AG7 and then pulled apart to give the correct winding length.

Installation of the electrical components should present no problems. To insulate it from the chassis, capacitor C_1 is mounted on a small ceramic cone insulator (Johnson 135–500 or National GS-10). The socket for the 6DQ5 is mounted above the chassis on a pair of ¾-inch sleeves, with a large clearance hole under the socket for the several leads running from under the chassis. Cathode and screen bypass capacitors for the 6DQ5 connect to the chassis at soldering lugs under the sleeves.

Taps on L_2 are readily made by first pushing the wire on either side of the desired turn toward the center of the coil.

Note that shielded wire is used for many of the a.c. and d.c. (but not r.f.) power leads; this is done to minimize the chances for stray radiation and it also contributes to the stability of the transmitter.

Adjustment

When the wiring is completed and checked, disable the amplifier stage by removing P_2, plug in P_3 and turn on S_5. The tube heaters and filaments should light up. If a voltmeter is available and connected across C_6, it should indicate over 500 volts. Later on, with full loading, the plate voltage will run around 400.

With S_1 switched to an 80-meter crystal, S_3 switched to 80 or 40 and S_5 switched to GRID, flip S_2 to SPOT and tune C_1 through its range. If the crystal is oscillating the meter should give an indication at some setting of C_1. The grid current reading should vary with the setting of C_1 (maximum at resonance) and with the setting of R_1 (maximum with arm at 20K end). If a key is plugged in at J_3 and S_2 is set to OPER, the grid current should appear only when the key is closed. Listen to the signal on a receiver (no antenna); if the signal is chirpy try adjusting the 3–30 pf. compression trimmer between grid and cathode of the 6AG7.

With a 40-meter crystal switched in, check for grid current at 14 and 21 Mc., by switching S_3 to the desired band and tuning with C_1. These settings should be checked with an absorption-type wavemeter, since it is possible in some cases to find more than one harmonic in the range of C_1. The 28-Mc. range can also be checked, but the 4th harmonic of the 7-Mc. crystal will yield only about 1 ma. of grid current.

Next check the neutralization on the 15-meter band. With 21-Mc. grid current indicating, switch S_4 to 15, set C_4 at half scale, and swing C_3

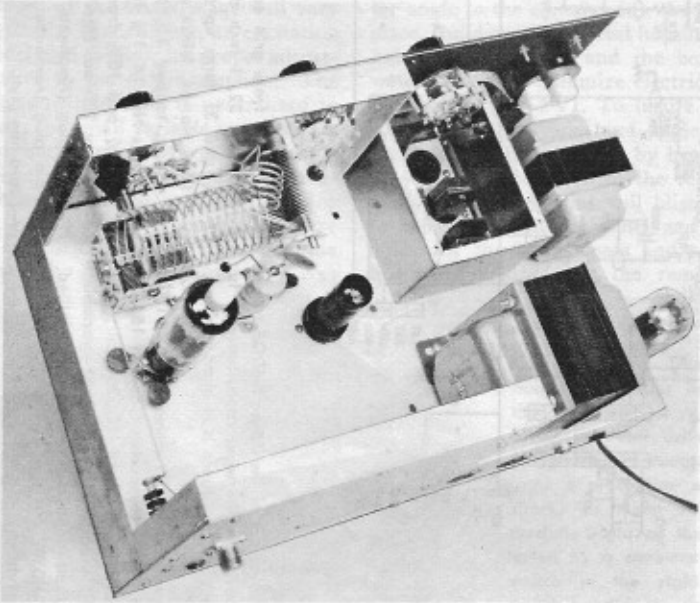

Fig. 6-45—Top view of the 6DQ5 transmitter with cane-metal cover removed. A 3 × 4 × 5-inch utility box (upper right) serves as a shield for the crystals; the cane-metal protection for the meter switch is fastened to the box cover. Phono jack mounted on the meter-side of the box receives v.f.o. output; short length of Twin-Lead from this jack to octal plug brings v.f.o. output to crystal socket. For protection against high voltage, meter terminals are covered by ceramic tube plate caps (Millen 36001).

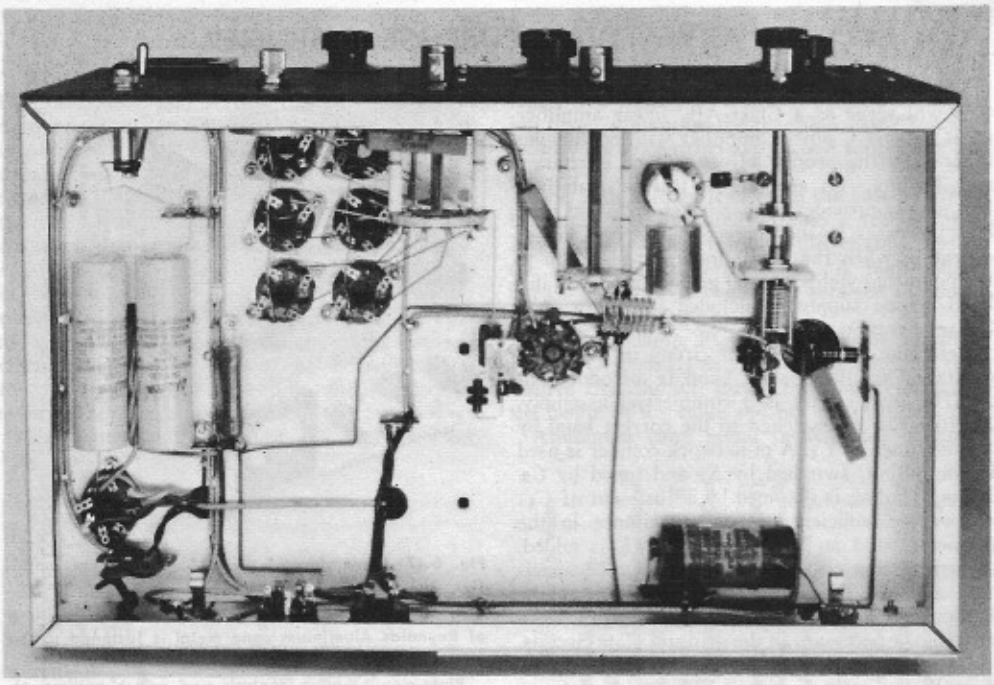

Fig. 6-46—Group of six octal sockets (upper left) serves as crystal sockets. Socket at center of chassis holds 6AG7 oscillator tube; the 3—30-pf. mica compression trimmer mounted alongside is excitation control for oscillator stage. Small midget capacitor above coil is neutralizing capacitor adjusted from above chassis; this capacitor and grid tuning capacitor to right must be insulated from chassis.

through its range. Watch closely for a flicker in grid current. If one is observed, try a different setting of C_2. Work carefully until the flicker is a minimum. A more sensitive indication of neutralization can be obtained by using a germanium diode and a 0–1 milliammeter in the output at J_2; adjust C_2 for minimum meter indication. If using this sensitive test, it is wise to start out with R_1 set at half range or less, until it has been determined that the meter will not swing off scale. Under no circumstances use this test with P_2 in place; the 6DQ5 output is quite likely to destroy the crystal diode.

When the amplifier has been neutralized, connect a dummy load (a 60-watt lamp will do) at J_2 and replace P_2. Set S_5 to PLATE and send a few dots as C_3 is tuned through its range. At resonance the lamp should light up and the plate current should dip. The plate current can be made to increase, along with the lamp brilliance, by decreasing the capacitance at C_4. The 6DQ5 plate current can be run up to 180 ma. (9 ma. on the meter) for Novice work; the grid current should be held at 2 to 4 ma. Crystals in the 3.5- to 4.0-Mc. range should be used for 80- and 40-meter operation, and 7-Mc. crystals should be used on 40, 20 and 15 meters. For 10-meter operation, it is recommended that a v.f.o. with 20-meter output be used to drive the 6AG7; trying to drive the 6DQ5 with the 4th harmonic of a 7-Mc. crystal is too marginal for all but the most experienced operators. With v.f.o. control, always frequency multiply (double or triple) in the 6AG7 stage to the desired band.

Because the 6DQ5 is capable of drawing high values of plate current when not tuned properly, it will pay to take care in learning how to adjust the transmitter. Once the controls have been "calibrated" and the approximate settings for each band become known, it should no longer be necessary to tune up with the "series-of-dots" technique mentioned above. However, in the early stages of familiarization with the transmitter, the dots, or a fast hand on the key, may save a tube or power supply. The fact that the 6DQ5 can draw such heavy currents at low plate voltages makes it an excellent tube for an effective inexpensive transmitter, but the tube is not as tolerant of careless tuning habits as are some other tubes.